Lucas Aerospace

OPERATION AND SERVICE MANUAL

RF CONTROL UNIT
MODEL 1805B

MP MASTER
MA35049

Lucas Weinschel

Attention!

OPERATION ALERT

TO: All 1805B and 1806 Users

REFERENCE: Temperature Control Meter

This Manual makes references to the **GREEN BAND** located on the Temperature Control Meter as a visual indicator for normal operating temperature limits. Take NOTE that some mounts may cause the meter to indicate above or below this **GREEN BAND**. This does not affect the normal operation of the 1805B and 1806, if the ERROR indicator is not illuminated and the meter needle is stable and does not drift or vibrate erratically. But if the meter needle is deflected full scale and the **ERROR** indicator is illuminated, return the **POWER** switch to **STANDBY** and refer to the Operation and Troubleshooting sections located in this manual.

If you have any questions or wish to discuss the System II's operation, please contact Lucas Weinschel at 301-948-3434.

Lucas Aerospace

Lucas Weinschel
P. O. 6001, Gaithersburg, Maryland 20884-6001
TEL: (301) 948-3434, 800-638-2048
TELFAX: 301-948-3625, TLX: 440702

OPERATION AND SERVICE MANUAL

RF CONTROL UNIT
MODEL 1805B

REVISION INFORMATION IS LOCATED AT THE

REAR OF THIS MANUAL

© LUCAS WEINSCHEL INC

GAITHERSBURG, MARYLAND

1989

WARRANTY

Lucas Weinschel Inc

PRODUCTS-

Lucas Weinschel Inc warrants each product it manufactures to be free from defects in material and workmanship under normal use and service anywhere in the world. Lucas Weinschel Inc's only obligation under this Warranty is to repair or replace, at its plant, any product or part thereof that is returned with transportation charges prepaid to Lucas Weinschel Inc. by the original purchaser within ONE YEAR from the date of shipment.

The foregoing Warranty does not apply to, and in Lucas Weinschel Inc's sole opinion, products that have been subject to improper or inadequate maintenance, unauthorized modifications, misuse, or operation outside the environmental specifications for the product.

SOFTWARE PRODUCTS-

Lucas Weinschel Inc software products are supplied without representation or Warranty of any kind. Lucas Weinschel Inc., therefore, assumes no responsibility and will not accept liability (consequential or otherwise) arising from the use of program materials, disc, or tape.

The Warranty period is controlled by the Warranty document furnished with each product and begins on the date of shipment. All Warranty returns must be authorized by Lucas Weinschel Inc prior to their return.

Lucas Weinschel Inc reserves the right to make changes in the design of its products at any time without incurring any obligation to make those changes on products that it has previously sold.

THE WARRANTY STATED ABOVE IS YOUR SOLE AND EXCLUSIVE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. LUCAS WEINSCHEL INC SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT OR OTHERWISE.

TABLE OF CONTENTS

Paragraph		Page
	SECTION 1 **GENERAL INFORMATION**	
1.1	Scope of Manual	1-1
1.2	Purpose and Use of Equipment	1-1
1.3	Items Supplied	1-2
1.4	Specifications	1-2
	SECTION 2 **INSTALLATION**	
2.1	Introduction	2-1
2.2	Unpacking and Inspecting the Model 1805B	2-1
2.3	Mounting and Environmental Considerations	2-2
2.4	1805B Power and Fusing Considerations	2-2
2.4.1	Line Voltage Power Input Connector and Voltage Assembly Selector/Fuse	2-2
2.4.1.1	Voltage Selector Fuse Subassembly	2-4
2.4.1.2	AC Power Input Connector	2-4
2.5	Rear Panel Controls and Connections	2-6
2.5.1	IEEE-488 INTERFACE BUS Connector (J3)	2-6
2.5.2	ADDRESS Switch	2-7
2.5.3	+ AM MODDULATION Connector (J2)	2-9
2.5.4	REMOTE PROGRAM INPUT Connector (J4)	2-9
2.5.5	REMOTE PROGRAM OUTPUT Connector (J5)	2-9
2.5.6	– AM MODULATION Connector (J6)	2-10
2.6	Preparation for Reshipment or Storage	2-10
	SECTION 3 **OPERATION**	
3.1	General Operating Considerations	3-1
3.2	Front Panel Displays, Controls, Indicators and Connectors	3-1
3.2.1	MOUNT BIAS Connectors (E1 and E2)	3-1
3.2.2	TEMPERATURE CONTROL Connector (J1)	3-1
3.2.3	LISTEN Indicator (DS6)	3-1
3.2.4	REMOTE Indicator (DS7)	3-3
3.2.5	STANDBY Indicator (DS5)	3-3
3.2.6	POWER Switch (S1)	3-3
3.2.7	ON Indicator (S1)	3-3
3.2.8	DC SUBSTITUTED POWER Switch (S3)	3-3
3.2.9	RF ON Indicator (DS2)	3-3
3.2.10	BRIDGE BALANCE Meter (M1)	3-4
3.2.11	RF OFF Indicator (DS1)	3-4
3.2.12	FINE NULL ADJUST Control (R1)	3-4
3.2.13	COURSE NULL ADJUST Control (R2)	3-4
3.2.14	ERROR Indicator (DS3)	3-4

TABLE OF CONTENTS (CONTINUED)

Paragraph		Page
	SECTION 3 (cont.) **OPERATION**	
3.2.15	RF ON/OFF Switch (S2)	3-5
3.2.16	TEMPERATURE Meter (M2)	3-5
3.3	Operating Instructions	3-5
3.3.1	Operating Precautions	3-5
3.3.2	Initial Power Application and Checkout	3-6
3.3.3	Local Control Operation	3-7
3.3.4	Remote Operation	3-8
3.3.4.1	System II Software	3-9
3.3.5	Terminating Operation	3-10
	SECTION 4 **PRINCIPLES OF OPERATION**	
4.1	Introduction	4-1
4.2	Principle of DC Substitution	4-1
4.3	RF Power Level Controller	4-2
	SECTION 5 **MAINTENANCE**	
5.1	Introduction	5-1
5.2	Preventive Maintenance	5-1
5.3	Troubleshooting Procedures	5-1
5.4	Test Equipment Required	5-2
5.5	Performance Tests	5-2
5.5.1	Initial Test Setup	5-2
5.5.2	DC Substitution Accuracy Test	5-4
5.5.3	Bias Power Range	5-4
5.5.4	Temperature Control Circuit Verification	5-5
5.5.5	System II Closed Loop Stability Test	5-5
5.5.5.1	Closed Loop Stability Test Setup	5-6
5.6	Calibration Procedures	5-10
5.6.1	Preliminary Calibration Procedures	5-10
5.6.2	30-Volt Reference Alignment	5-10
5.6.3	Motherboard Power Supply Test	5-11
5.6.4	DC Substitution Board Calibration	5-12
5.6.4.1	Check of Error Reference Voltage	5-12
5.6.4.2	Bridge Circuitry Alignment	5-12
5.6.4.3	Recheck of DC Substitution Accuracy and Bias Power Range	5-12
5.6.5	RF Amplifier Board Calibration	5-13
5.6.5.1	Bridge Power Meter (M1) Calibration	5-13
5.6.6	Temperature Control Meter Alignment	5-15
5.7	Contacting Weinschel Engineering	5-17

TABLE OF CONTENTS (CONTINUED)

Paragraph		Page
	SECTION 6 **REPLACEABLE PARTS**	
6.1	Introduction	6-1
6.2	Reference Designations	6-1
6.3	Ordering Information	6-1
	SECTION 7 **DRAWINGS AND CIRCUIT DESCRIPTIONS**	
7.1	Introduction	7-1

LIST OF TABLES

Table		Page
1-1	Items Supplied with the Model 1805B	1-2
1-2	Model 1805B Specifications	1-3
2-1	Model 1805B Line Voltage Fuse Requirements	2-5
2-2	Model 1805B IEEE-488 Interface Bus Pin Signal Designators	2-7
2-3	Address Switch Truth Table	2-8
3-1	Model 1805B Mnemonics for Remote Control	3-9
3-2	Controller Options and Available Software	3-10
5-1	Required Test Equipment	5-3
5-2	DC Substituted Power Settings for Closed Loop Stability Test	5-9
5-3	Motherboard Power Supply Check	5-11
5-4	1805B Temperature Control Meter Test Fixture Parts List	5-15
6-1	Model 1805B Overall Assembly, 138-415-1, Rev. B	6-2
6-2	Microprocessor Board Assy., A1, 138-398, Rev. D	6-3
6-3	DC Substitution P.C. Bd. Assy., 138-400, Rev. G	6-4
6-4	RF Amplifier P.C. Bd. Assy., A3, 138-449, Rev. M	6-6
6-5	Motherboard Power Supply Assy., A6, 138-404, Rev. K	6-7
6-6	+30 V Power Supply Assembly, A7, 138-419, Rev. H	6-8
6-7	Front Panel Assembly, A8, 138-394-1, Rev. B	6-9
6-8	Rear Panel Assembly, A9, 138-467-1, Rev. B	6-10

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Weinschel Engineering Model 1805B RF Control Unit	1-0
1-2	Model 1805B Physical Dimensions	1-5
2-1	Model 1805B Rear Panel	2-3
2-2	W/E Model 1805B's Operational Voltage Selection Process	2-5
2-3	Pin Location on Model 1805B IEEE-488 INTERFACE BUS Connector	2-6
2-4	Model 1805B ADDRESS Switch's Minor Switch Location and Their Numbering Scheme	2-8
3-1	Front Panel Displays , Controls, Indicators and Connectors	3-2
4-1	Simplified Schematic of RF Power Meter Level Controller System	4-3
5-1	Initial Test Setup	5-3
5-2	System II Closed Loop Stability Test Block Diagram	5-7
5-3	Closed Loop Stability Test Procedure	5-8
5-4	30-Volt Reference Alignment Configuration	5-11
5-5	Temperature Control Meter Test Fixture , Schematic Diagram	5-16
7-1	Model 1805B Overall Assembly	7-4
7-2	Model 1805B Overall Schematic	7-5
7-3	Functional Block Diagram of Microprocessor Board	7-6
7-4	Microprocessor P.C. Bd. Assy., Component Location	7-6
7-5	Microprocessor P.C. Bd. Assy., Schematic Diagram	7-7
7-6	Simplified Schematic Diagram of DC Substitution Circuit	7-8
7-7	DC Substitution P.C.Bd. Assy., A2, Component Location	7-8
7-8	DC Substitution P.C.Bd., Schematic Diagram	7-9
7-9	Functional Diagram of RF Amplifier Board	7-10
7-10	Simplified Schematic of Model 1805B Proportional Temperature Control Circuit	7-10
7-11	RF Amplifier P.C. Bd. Assy., A3, Component Location	7-10
7-12	RF Amplifier P.C. Bd. Assy., A3, Schematic Diagram	7-11
7-13	Power Supply and Motherboard Assembly, A6, Component Location	7-12
7-14	Motherboard Power Supply, A6, Schematic Diagram	7-13
7-15	+30 V Power Supply Assembly, A7, Component Location	7-15
7-16	Front Panel Assembly, A8, Component Location	7-16
7-17	Rear Panel Assembly, A9, Component Location	7-18

Figure 1-1. Weinschel Engineering Model 1805B RF Control Unit

SECTION 1
GENERAL INFORMATION

1.1 SCOPE OF MANUAL

This manual provides general information, installation procedures, operating instructions, verification procedures, maintenance instructions, replaceable part information, and schematic diagrams for the Weinschel Engineering Model 1805B RF Control Unit which is pictured in Figure 1-1. For a complete description of the role and use of the 1805B in a power measurement system, its operating procedure in the system, and its system interconnection, refer to the Weinschel Engineering *System IIA Automatic Power Meter Calibration System Manual* (IM198).

1.2 PURPOSE AND USE OF EQUIPMENT

The Model 1805B RF Control Unit, shown in Figure 1-1, is a solid-state, microprocessor-controlled RF control unit designed for precise control of dc substituted power. It is one component of the Weinschel Engineering System IIA Automatic Power Meter Calibrator System whose purpose is to accurately transfer the calibration factor of National Bureau of Standards (NBS) standards to feedthrough and terminating bolometer mounts. When used with thermistor mounts such as the Weinschel Engineering Model 1109 Feedthrough Thermistor Mount or the Weinschel Engineering Model 1110 Terminating Thermistor Mount, an appropriate power meter (such as the Weinschel Engineering Model 1806 Dual NBS Type IV Power Meter), and an RF generator such as the Weinschel Engineering Model 4372 Synthesized Signal Source, a system is obtained which allows rapid and accurate calibration of power meter mounts from .01 to 18 GHz. The 1805B is flexible enough to be used in a variety of power meter sensor calibration systems. (Refer to the Weinschel Engineering *System IIA Automatic Power Meter Calibrator System Manual* for 1805B connection and operation instructions in the System IIA context.) Other outstanding features include:

A. IEEE-488 Bus or front panel selection of precise dc power levels. These levels are .5 mW and 1-10 mW in 1 mW steps.

B. IEEE-488 Bus or front panel RF ON/OFF switching.

C. Elimination of ac/dc error by using dc for both bias and substituted power.

D. Automatic control of dc level to within ±0.1% + 1 μW.

E. Constant dc level over an ambient temperature range of from +12° to +40°C.

F. Capability to correct RF source level variations of ±3 dB.

G. Internal temperature controller for controlling internal temperature of thermistor mount.

1.3 ITEMS SUPPLIED

Table 1-1 lists the items supplied with the Model 1805B RF Control Unit.

Table 1-1. ITEMS SUPPLIED WITH THE MODEL 1805B

ITEMS SUPPLIED	PART NUMBER
1805B Operation and Service Manual	IM200
Printed Circuit Card Puller	139-1141
AC Power Cable	068-21
Cable Assembly, Temperature Control	138-477
Cable Assembly, Mount Bias	138-526
Cable Assembly, Remote Program, 1805B to 4311B	138-490-1
Cable Assembly, Remote Program, 1805B to 4310	138-490-2
Cable Assembly, AM Modulation	139-492
Cable Assembly, Band Select, 1805B to 430C	138-552

1.4 SPECIFICATIONS

Table 1-2 provides the operating specifications (electrical and physical) of the Model 1805B RF Control Unit. Figure 1-2 provides an outline drawing of the unit and shows dimensions.

Table 1-2. MODEL 1805B SPECIFICATIONS

ITEM	SPECIFICATION
GENERAL	
Temperature Range:	+ 12° to + 40°C
Power Requirements:	100/120/220/240 VAC ± 10% 48 - 62 Hz 40W nominal
Dimensions:	17.5" (44.45 cm) L × 8.4" (21.33 cm) W × 7" (17.78 cm) H
Weight: Net: Shipping:	 13 lbs (5.9 kg) 18 lbs (8.16 kg)
Construction:	Cabinet or Standard Rack (1/2-Rack) Mount
OPERATING MODES	
Remote:	IEEE-488-1978 full function Bus Control RF ON/OFF Substituted dc Power Levels (.5 mW and 1-10 mW in 1 mW steps)
Local:	RF ON/OFF Substituted dc Power Levels (.5 mW and 1-10 mW in 1 mW steps)
DC SUBSTITUTION	
DC Substituted Power Level Range:	0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 mW
DC Substituted Power Accuracy (at 30 ± .7 mW bias power):	± 0.1% + 5 µW
Bias Power Range:	29 - 31 mW , automatic with error indication for out-of-range balance condition
Power Level Control Range:	approximately 3 - 23 dB minimum (dependent upon specific signal source)
Leveled RF Power (Referenced to DC Substituted Power) Dynamic Range:	± 3 dB
Unbalance Detector: Sensitivity: Resolution:	 2 µW/division 0.2 µW
Leveler Loop Gain:	80 dB minimum

Table 1-2. MODEL 1805B SPECIFICATIONS (Continued)

ITEM	SPECIFICATION
TEMPERATURE CONTROLLER	
Bias Power Temperature Sensitivity:	<2 μW/C°/hr
Ambient Temperature Dynamic Range:	+ 12° to + 40°C
Mount Warm-up Time:	2 hrs. nominal
Internal Temperature:	+ 60°C nominal
Loop Gain:	80 dB minimum
Open Loop Frequency Response:	0.1 Hz
Warm-Up Drive (Saturated):	8-10 V at 200 mA minimum
Indicator:	Voltmeter with marked operating point

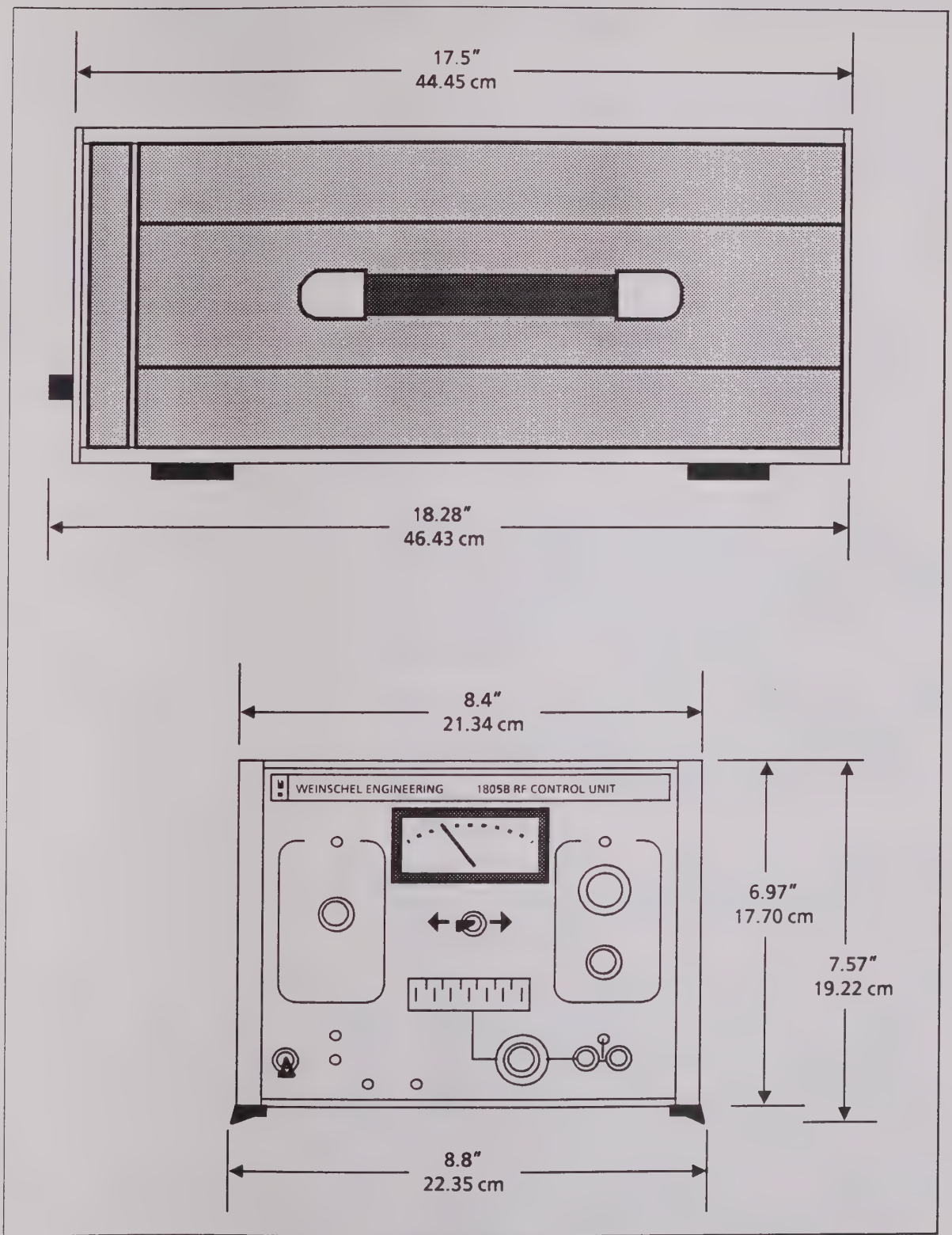


Figure 1-2. Model 1805B Physical Dimensions

SECTION 2
INSTALLATION

2.1 INTRODUCTION

This section contains unpacking, inspection, shipping, storage, and installation instructions for the Model 1805B. These installation instructions consider power, mounting, environmental and other requirements of the unit.

2.2 UNPACKING AND INSPECTING THE MODEL 1805B

UNPACKING

Weinschel Engineering ships the Model 1805B cushioned between molded-in-place expanded plastic pads in a double-walled carton. Upon unpacking the equipment, retain the shipping container and packing material until the equipment has been thoroughly inspected and it is ensured that reshipment is not necessary. Perform the following initial inspection:

INSPECTION

A. Carefully look at the outside of the shipping container for discoloration, stains, charring, or other signs of exposure to excessive heat, moisture, or liquid chemicals. Check for any physical damage to the shipping container such as dents, snags, rips, crushed sections or areas, or similar signs of excessive shock or careless handling.

B. Remove all equipment and any accessory packages from the shipping container. Check each item against the packing list or Items Supplied list in Table 1-1. If any items are missing, either contact the factory or the manufacturer's local representative.

C. Carefully inspect the equipment looking for dents, deep scratches, damaged or loose pushbuttons or knobs, or any other signs of physical abuse or careless handling.

DAMAGE

If damage is found, forward an immediate request to the delivering carrier to perform an inspection and prepare a concealed-damage report. Do not destroy any packing material until it has been examined by an agent of the carrier. Concurrently, report the nature and extent of damage to Weinschel Engineering, giving equipment model and serial numbers, so that necessary action can be taken. Under U.S. shipping regulations, damage claims must be collected by the consignee; do not return the equipment to Weinschel Engineering until a claim for damages has been established. See Section 5 for informaton concerning contacting Weinschel Engineering.

2.3 MOUNTING AND ENVIRONMENTAL CONSIDERATIONS

MOUNTING

The Model 1805B is shipped equipped for bench use with four plastic feet mounted in place. The unit is half-rack wide and, after its feet have been removed, it can be rack mounted using the Weinschel Engineering Model 1919 Half-Rack Mounting Kit. Figure 1-2 shows the physical dimensions of the unit.

ENVIRONMENTAL

The Model 1805B is designed to operate within its specifications at an ambient temperature of +12° to +40°C. Operating in ambient temperatures beyond these limits could affect the accuracy of the instrument and possibly damage internal circuitry.

2.4 1805B POWER AND FUSING CONSIDERATIONS

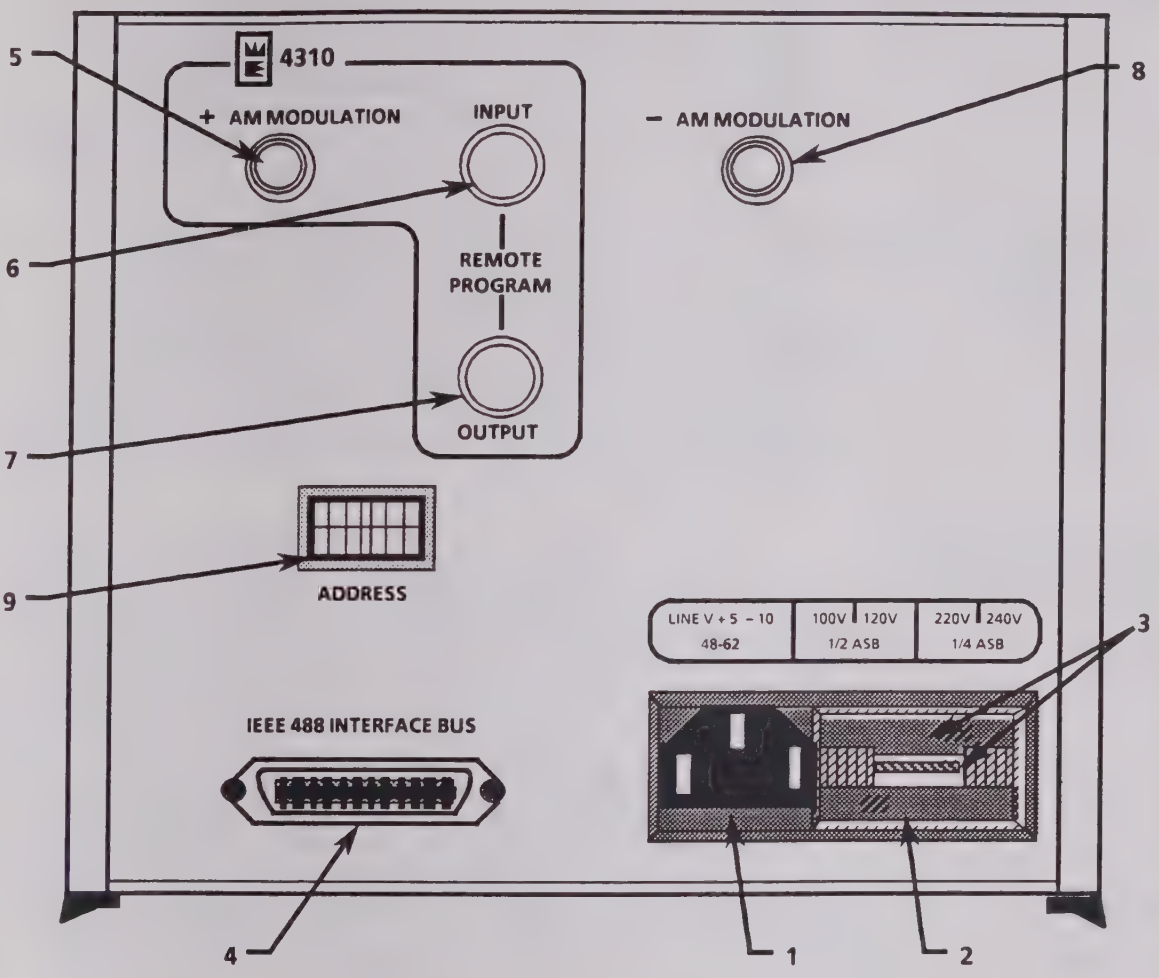
Installation of the 1805B requires the connection of an ac power cord to the rear panel Line Voltage Power Input Connector and Voltage Selector/Fuse Assembly. However, before making the power input connection, this assembly must be set for the correct operating voltage and must contain the correct fuse. Paragraph 2.4.1 contains instructions for replacing the fuse and setting the operating voltage.

2.4.1 Line Voltage Power Input Connector and Voltage Assembly Selector/Fuse

WARNING

Sufficient power levels are present at the Voltage Selector/Fuse Assembly to cause personal injury, or severe damage to the 1805B. Make sure that the 1805B's power cord is disconnected before attempting to change fuses.

The Line Voltage Power Input Connector and Voltage Selector/Fuse Assembly XF1 is in the lower right-hand corner of the 1805B's rear panel. Refer to Figure 2-1. This assembly contains a three-prong ac power input connector and a voltage selector circuit board/fuse assembly. The design of XF1 prevents access to the voltage selector/fuse assembly while an ac power cord is connected to the ac power input connector. Removing the power cord allows shifting of the plastic window from right to left to access the fuse assembly. This arrangement reduces the possibility of electric shock to operating personnel.



1. Power Input Connector
2. Quad-Reversible Printed Circuit Wafer for Selection of AC Power Level (XF1)
3. Fuse (F1) and **FUSE PULL** lever
4. **IEEE-488 INTERFACE BUS** Connector (J3)
5. **+ AM MODULATION** Connector (J2)
6. **REMOTE PROGRAM - INPUT** Connector (J4)
7. **REMOTE PROGRAM - OUTPUT** Connector (J5)
8. **− AM MODULATION** Connector (J6)
9. **ADDRESS** Switch (7-section miniature DIP switch)

Figure 2-1. Model 1805B Rear Panel

2.4.1.1 VOLTAGE SELECTOR/ FUSE SUBASSEMBLY

The voltage selector/fuse subassembly, on the right side of XF1, reconfigures the 1805B for different operational voltages. This subassembly contains a Line Voltage fuse and a Voltage Selector PC board. Replacement of the fuse and proper selection of the Voltage Selector PC board change the operational power requirement to 100, 120, 220 or 240 Vac.

SELECTING THE PROPER FUSE AND CIRCUIT BOARD FOR XF1

When shipping within the U.S., Weinschel Engineering configures the 1805B for 120-Volt operation. Overseas shipments may vary. Table 2-1 lists fuse requirements for the available operational voltages. Figure 2-2 depicts the procedure for removal of the Line Voltage fuse, selection of the proper Line Voltage PC board, and replacement of the fuse. After completing the steps in Figure 2-2, the 1805B is ready for operation at the new voltage.

2.4.1.2 AC POWER INPUT CONNECTOR

This connector, located on the left side of XF1, is a plug-type, prong-insert connector with three conductors for connection of the 120/240-Vac power cord (P/N 068-21) to the Power Supply assembly within the 1805B. The plastic window must be pushed to the right to make this connection. Arrangement of the conductors and keying of the insertion are to prevent an incorrect connection. This connector also passes the ground current of the 1805B when the ac power cord is plugged into a grounded wall outlet. When the wall outlet contains two insertion slots, use a three-prong-to-two-prong adaptor and connect the adaptor's ground lead to the retaining screw of the outlet plate.

Table 2-1. MODEL 1805B LINE VOLTAGE FUSE REQUIREMENTS

Operational Line Voltage	Fuse Requirement	WE P/N
100 or 120 Volts	1/2 A SLO BLO	052-1-1/2SB
220 or 240 Volts	1/4 A SLO BLO	052-1-1/4SB

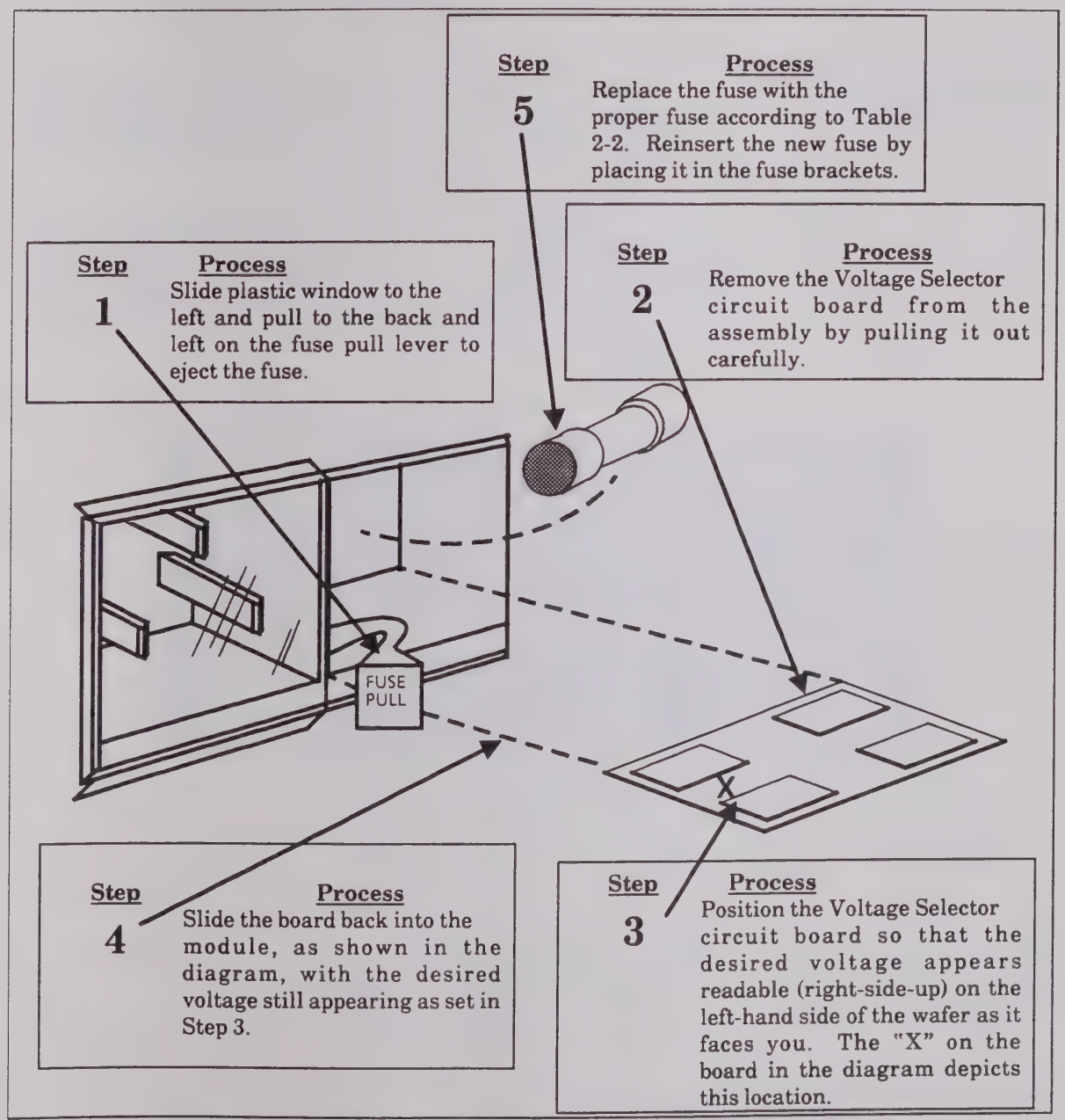

Step 5
Process
Replace the fuse with the proper fuse according to Table 2-2. Reinsert the new fuse by placing it in the fuse brackets.
Step 1
Process
Slide plastic window to the left and pull to the back and left on the fuse pull lever to eject the fuse.
Step 2
Process
Remove the Voltage Selector circuit board from the assembly by pulling it out carefully.
FUSE PULL
X
Step 4
Process
Slide the board back into the module, as shown in the diagram, with the desired voltage still appearing as set in Step 3.
Step 3
Process
Position the Voltage Selector circuit board so that the desired voltage appears readable (right-side-up) on the left-hand side of the wafer as it faces you. The "X" on the board in the diagram depicts this location.

Figure 2-2. W/E Model 1805B's Operational Voltage Selection Process

2.5 REAR PANEL CONTROLS AND CONNECTIONS

The following paragraphs contain information pertaining to the rear panel connectors and control switches other than the Voltage Selector/Fuse Assembly (SF1) and the AC Power Input Connector described in Paragraphs 2.4.1.1 and 2.4.1.2 respectively. Figure 2-1 shows the location of each item. Refer to Appendix A for further information on making connections.

2.5.1 IEEE-488 INTERFACE BUS Connector (J3)

Joining the 1805B to a system controller requires the connection of the IEEE-488 bus to the 1805B's **IEEE-488 INTERFACE BUS** connector (J3), located on the left side of the rear panel. Refer to Figure 2-1.

The **IEEE-488 INTERFACE BUS** connector carries program command and data signals passing between the 1805B and a system controller. Figure 2-3 illustrates the connector's contact pin numbering scheme and Table 2-2 lists the signal designator for the signal present at each contact pin.

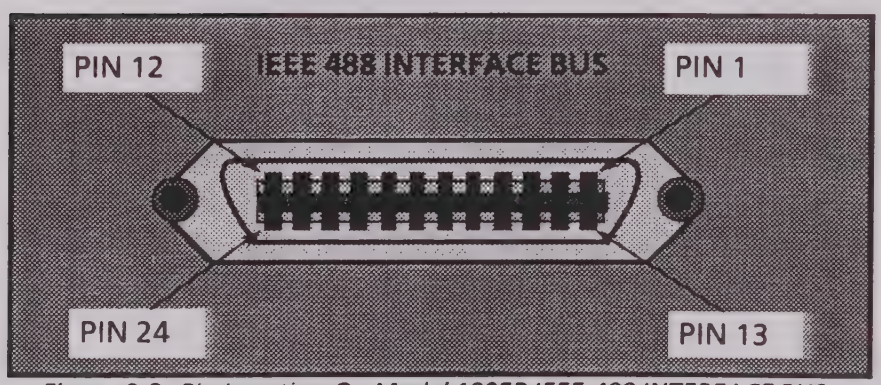


Figure 2-3. Pin Location On Model 1805B IEEE-488 INTERFACE BUS Connector

Table 2-2. MODEL 1805B IEEE-488 INTERFACE BUS PIN SIGNAL DESIGNATORS

Pin No.	Signal Line	Pin No.	Signal Line
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI (24)**	17	REN (24)**
6	DAV	18	GND (6)*
7	NRFD	19	GND (7)*
8	NDAC	20	GND (8)*
9	IFC	21	GND (9)*
10	SRQ	22	GND (10)*
11	ATN	23	GND (11)*
12	SHIELD	24	GND, LOGIC

* Gnd (n) refers to the signal ground return of the referenced pin.

** Return on pin 24.

2.5.2 ADDRESS Switch

Remote operation of the 1805B requires setting its IEEE-488 **ADDRESS** switch for a unique five-bit address. The **ADDRESS** switch is located to the left of the **IEEE-488 BUS** connector on the rear panel. Refer to Figure 2-1.

The **ADDRESS** switch contains seven small switches that are numbered from left to right; however, only switches 1 thru 5 are used for selecting the unit address. Switch 1 is the least significant bit (LSB). Addresses 0 thru 30 are valid. Address 31 is invalid. Figure 2-4 is a view of the **ADDRESS** switch showing the switches' numbering scheme. Table 2-3 is a truth table that lists switch 1 thru 5 positions (0 or 1) for addresses 1 thru 10, 20, and 30.

To code a particular address, set switches 1 thru 5 to either **ON** (push top of switch in) or **OFF** (push bottom of switch in) to code a binary 1 or 0, respectively. Notice that when the **ON** position is selected, a red band appears in the **ON** position.

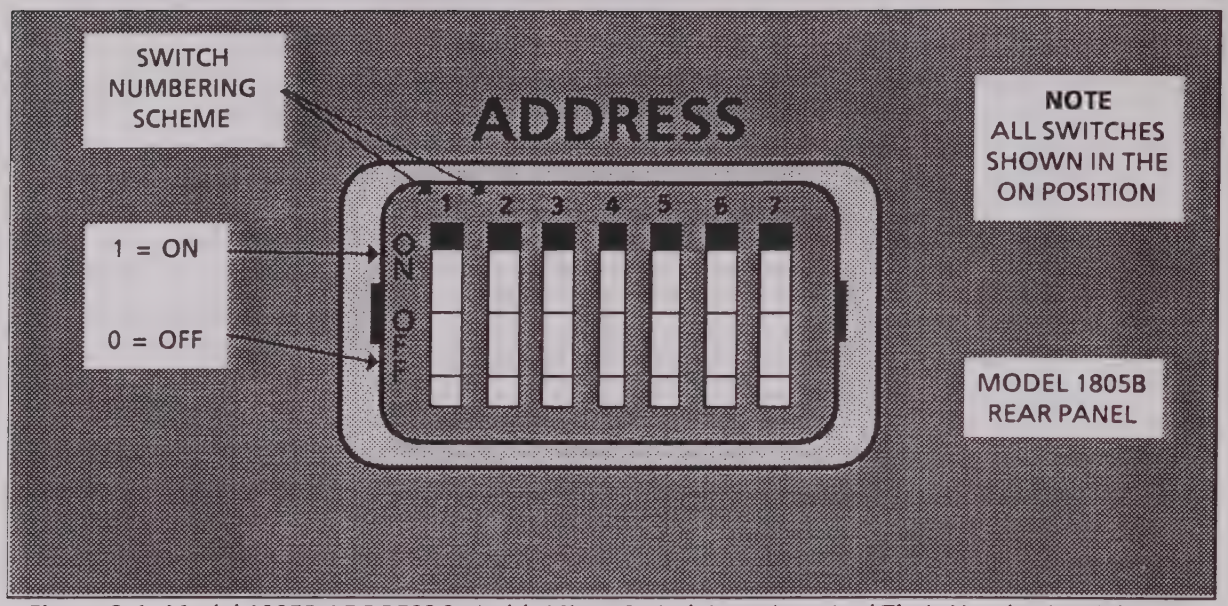


Figure 2-4. Model 1805B ADDRESS Switch's Minor Switch Locations And Their Numbering Scheme

Table 2-3. ADDRESS SWITCH TRUTH TABLE

Switch Number	1	2	3	4	5
Decimal Weight	1	2	4	8	16
Address					
0	0	0	0	0	0
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
20	0	0	1	0	1
30	0	1	1	1	1

2.5.3 + AM MODULATION Connector (J2)

The **+ AM MODULATION** connector (J2) is a BNC-type connector which is located in the upper left-hand corner of the rear panel (Refer to Figure 2-2). The signal present at this connector is the power leveling output voltage which controls the power output level of signal generators such as a W/E 4310A/KN Multiband Sweeper System whose power increases with a positive-going signal and decreases with a negative-going signal. The 1805B may also be used to control the power output level of a W/E 4312 System, 4312A System or a 4370 series Signal Source (Refer to the *System IIA Automatic Power Meter Calibration System Operation and Service Manual* (IM198) for cabling instructions).

2.5.4 REMOTE PROGRAM - INPUT Connector (J4)

The **REMOTE PROGRAM - INPUT** Connector (J4) is a nine-pin connector located in the upper left-hand corner of the rear panel within a prominently marked area labeled "4310". This connector receives a five-digit BCD signal which carries RF band select commands, and re-routes this signal to the **REMOTE PROGRAM - OUTPUT** Connector (J5).

This connector is only used with an RF generator when it is configured within a 4312 or 4312A Automatic Phase-Locked Source System. When an 1805B is operated with a 4312 System, this connector receives RF band select data from the 4311B's rear panel **REMOTE PROGRAM - OUTPUT** Connector (J5) for re-routing to an RF generator. When an 1805B is operated with a 4312A System, this connector accepts RF band select data from the HP 59301A ASCII-to-Parallel Converter's J2 connector (Columns 11-16).

2.5.5 REMOTE PROGRAM - OUTPUT Connector (J5)

The **REMOTE PROGRAM - OUTPUT** Connector (J5) is a nine-pin quick-disconnect connector located in the left-hand center part of the rear panel wthin a prominently marked area labelled "4310". When the Model 1805B is operated with an RF generator not configured within a phase-lock source system, this connector relays an RF ON/OFF command from the 1805B's RF Power Board to the generator's rear panel **REMOTE PROGRAM - INPUT** Connector. When the Model 1805B is operated with a 4312 or 4312A Phase-Lock Source System, this connector also routes five bit RF band select commands, received at the 1805B's **REMOTE PROGRAM - INPUT** connector (J4) to the RF generator's rear panel **REMOTE PROGRAM - INPUT** Connector.

2.5.6 – AM MODULATION

Connector (J6)

Connector J6 is a BNC-type connector which is located near the upper right-hand corner of the rear panel. The signal present at J6 is a control voltage which provides RF level control to signal generators, whose power output decreases with positive-going signal and increases with negative-going signal.

2.6 PREPARATION FOR RESHIPMENT OR STORAGE

RESHIPMENT

Refer to Paragraph 5.4 for further information concerning shipment of a unit to Weinschel Engineering for repair. Use the best packaging materials available to protect the unit during storage or reshipment. When possible, use the original packing container and cushioning material. If the original packing materials are not available, use the following procedure:

A. Wrap the instrument in sturdy paper or plastic.

B. Place the wrapped instrument in a strong shipping container and place a layer of shock-absorbing material (3/4-inch minimum thickness) around all sides of the unit to provide a firm cushion and to prevent movement inside the container.

C. If shipping the unit for service, attach a tag to indicate:

1. model and serial numbers,
2. service required,
3. description of malfunction,
4. return address,
5. authorization to conduct repairs or to calibrate, and
6. instrument return authorization.

D. Thoroughly seal the shipping container and mark it **FRAGILE.**

E. Ship to:

Lucas Weinschel
P.O. BOX 6001
One Weinschel Lane
Gaithersburg, MD 20884-6001
U.S.A.

or to an authorized sales representative.

STORAGE

When storing the 1805B for extended periods, follow the packing instructions contained in this paragraph to prevent damage to internal circuitry. The safe limits for storage environment are:

Temperature: −67° to +167° F (−55° to +75° C)

Humidity: less than 95%

Altitude: less than 40,000′ (12,192 m)

SECTION 3
OPERATION

3.1 GENERAL OPERATING CONSIDERATIONS

The primary purpose of the Model 1805B RF Control Unit is to ensure precision results in the transfer of calibration factors of National Bureau of Standards (NBS) standards to bolometer mounts, secondary standards or power meters. The instrument is designed as one element within a calibration system comprised of several precision components. An example of such a system is the Weinschel Engineering Automatic Power Meter Calibration System IIA-ASC. **Regardless of system configuration, an understanding of all components of the system is essential for proper operation of the Model 1805B.** For more information on the use of the 1805B in a typical system, refer to the Weinschel Engineering*System IIA Automatic Power Meter Calibration System Operation and Service Manual* (IM198).

3.2 FRONT PANEL DISPLAYS, CONTROLS, INDICATORS AND CONNECTORS

The following paragraphs contain information pertaining to the front panel displays, controls indicators and connectors. Figure 3-1 shows the location of each item. Refer to Appendix A for further information on making connections.

3.2.1 MOUNT BIAS Connectors (E1 and E2)

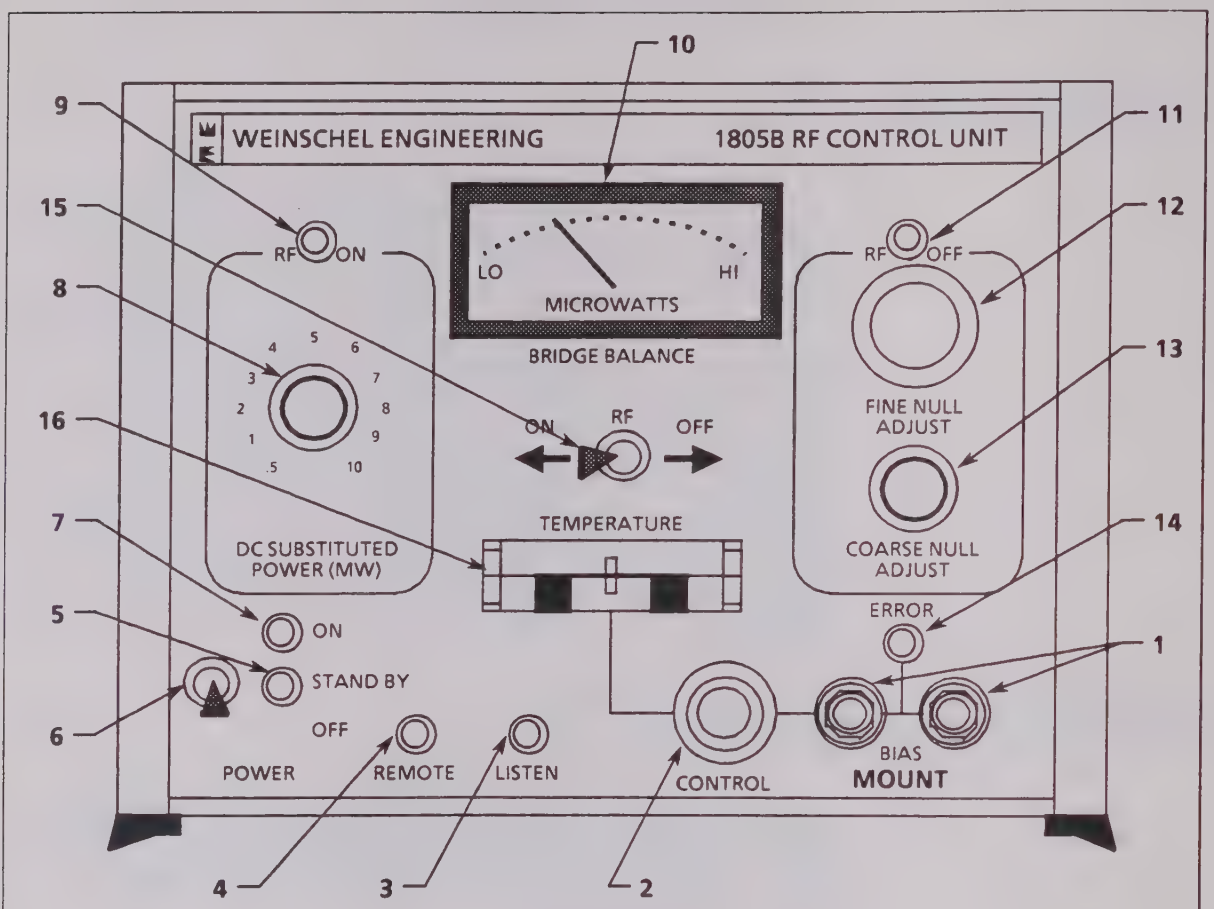
Connectors E1 and E2 are spade-lug connecting posts which are located in the lower right-hand corner of the front panel. Present at these connectors is the dc bias voltage to be applied to the thermistor mount. Per convention, red is +dc while black is −dc.

3.2.2 TEMPERATURE CONTROL Connector (J1)

Connector J1, located near the lower right-hand corner of the front panel, is a four (4) pin threaded connector which provides the current required to control the internal temperature of the thermistor mount.

3.2.3 LISTEN Indicator (DS6)

The LISTEN indicator (DS6) is a red LED located in the bottom center of the front panel. DS6 is only illuminated when the 1805B is addressed as a listener via the IEEE-488 bus.



1. **MOUNT BIAS** Connectors (E1 and E2)
2. **TEMPERATURE CONTROL** Connector (J1)
3. **LISTEN** Indicator (DS6)
4. **REMOTE** Indicator (DS7)
5. **STANDBY** Indicator (DS5)
6. **POWER** Switch (S1)
7. **ON** Indicator (DS4)
8. **DC SUBSTITUTED POWER** Switch (S3)
9. **RF ON** Indicator (DS2)
10. **BRIDGE BALANCE** Meter (M1)
11. **RF OFF** Indicator (DS1)
12. **FINE NULL ADJUST** Control (R1)
13. **COARSE NULL ADJUST** Control (R2)
14. **ERROR** Indicator (DS3)
15. **RF ON/OFF** Switch (S2)
16. **TEMPERATURE** Meter (M2)

Figure 3-1. Front Panel Displays, Controls, Indicators and Connectors

3.2.4 REMOTE Indicator (DS7)

The **REMOTE** indicator (DS7) is a red LED located in the bottom center of the front panel. DS7 is only illuminated when the 1805B is under IEEE-488 bus control.

3.2.5 STANDBY Indicator (DS5)

The **STANDBY** indicator (DS5) is an amber LED located near the lower left-hand corner of the front panel. When the **POWER** switch (S1) is toggled to the **STANDBY** position (middle position), DS5 illuminates, indicating that +30 V power has been applied to allow pre-heating of the precision resistor network within the 1805B, and that the +20 V temperature controller circuit for the thermistor mount has been activated.

3.2.6 POWER Switch (S1)

The **POWER** switch (S1) is a three (3) position toggle switch located near the lower left-hand corner of the front panel. In the down or **OFF** position all power is removed from the 1805B internal and controlled external circuitry. In the middle or **STANDBY** position, +30 V is applied for pre-heating the internal precision resistor network, +20 V is applied to the temperature controller circuit for pre-heating the thermistor mount, and the amber **STANDBY** indicator (DS5) is illuminated. In the up or **ON** position, all required power for operation is applied to the 1805B, and the green **ON** indicator (DS4) is illuminated.

3.2.7 ON Indicator (DS4)

The **ON** indicator (DS4) is a green LED located near the lower left-hand corner of the front panel. When the **POWER** switch (S1) is toggled to the **ON** position, DS4 illuminates to indicate that all 1805B internal power supplies have been activated.

3.2.8 DC SUBSTITUTED POWER Switch (S3)

The **DC SUBSTITUTED POWER** switch (S3) is an eleven (11) position limited-rotation rotary switch located in the left-hand center of the front panel. When the 1805B is under manual control, S3 controls the level of the dc substituted power being supplied. The selectable levels are .5, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 milliwatts. Under IEEE-488 bus control, S3 is inactive.

3.2.9 RF ON Indicator (DS2)

The **RF ON** indicator (DS2) is a green LED located in the upper left-hand corner of the front panel. When the **RF ON/OFF** switch (S2) is toggled to the left (**ON**) position, DS2 illuminates, indicating that the selected dc substituted power level is supplied to the bridge, and the appropriate RF switching signals are routed to the rear panel. If the 1805B is under remote IEEE-488 bus

control, DS2 illuminates when the RF ON functions have been performed by the automatic system controller.

3.2.10 BRIDGE BALANCE Meter (M1)

The **BRIDGE BALANCE** meter (M1) is located at the top center of the front panel, and is scaled from a low of –10 microwatts to a high of +10 microwatts relative to a mid-meter scale reference of zero (0). A 0 reference level reading on M1 indicates that the level controlled by the 1805B corresponds exactly to the dc substituted power level selected on the **DC SUBSTITUTED POWER** switch (S3). Any deviation from the selected level is read on M1 as a low or high indication in microwatts. zin operation, **COARSE NULL ADJUST** control (R2) and FINE NULL ADJUST control (R1) are adjusted to achieve a 0 or "null" reading on M1 prior to application of RF power. After applying RF power (either manually via the **RF ON/OFF** switch (S2) or automatically via the IEEE-488 control bus) M1 should, after a momentary deviation, again achieve a null reading to indicate that the 1805B has "locked on" to the RF source and is applying the proper amount of dc substituted power for calibration purposes.

3.2.11 RF OFF Indicator (DS1)

The **RF OFF** indicator (DS1) is a green LED located in the upper right-hand corner of the front panel. When **RF ON/OFF** switch (S2) is toggled to the right (**OFF**) position, DS1 illuminates, indicating that 30 mW dc power is supplied to the bridge, and the appropriate RF switching signals are routed to the rear panel. If the 1805B is under remote IEEE-488 bus control, DS1 illuminates when the functions of RF OFF (0) have been performed by the automatic system controller.

3.2.12 FINE NULL ADJUST Control (R1)

The **FINE NULL ADJUST** control (R1) is a continuously-variable, knob-controlled potentiometer located near the upper right-hand corner of the front panel. R1 provides fine adjustment of the bridge balance reading on **BRIDGE BALANCE** meter (M1) prior to application of RF power.

3.2.13 COARSE NULL ADJUST Control (R2)

The **COARSE NULL ADJUST** control (R2) is a continuously-variable, knob-controlled potentiometer located in the right-hand center portion of the front panel. R2 provides coarse null adjustment of the bridge balance reading on the **BRIDGE BALANCE** meter (M1) prior to the application of RF power.

3.2.14 ERROR Indicator (DS3)

The **ERROR** indicator (DS3) is a red LED located near the lower right-hand corner of the front panel. DS3

is active only when RF power is NOT applied, and when illuminated, indicates either an open circuit (hookup or thermistor), or failure of the bridge to balance at 30 mW ± 1 mW.

3.2.15 RF ON/OFF Switch (S2)

The **RF ON/OFF** switch (S2) is a two-position toggle switch located near the center of the front panel. During manual operation, placing S2 in the left (ON) position applies RF power, activates the 1805B circuitry, deactivates the **RF ON** indicator (DS2) and activates the **RF OFF** indicator (DS1). During remote IEEE-488 bus-controlled operation, S2 is left in the **OFF** position and the automatic system controller performs the functions of S2.

3.2.16 TEMPERATURE Meter (M2)

The **TEMPERATURE** meter (M2) is located in the lower center of the front panel, and provides a dc voltage analog reading of temperature and temperature stability within the thermistor chamber. A green band on the meter scale provides a visual indication of normal operating temperature limits.

3.3 OPERATING INSTRUCTIONS

The 1805B RF Control Unit is designed as one component of a system whose purpose is to accurately transfer the calibration factors of NBS standards to feedthrough and terminating bolometer mounts, thermistor mounts, and power sensors. Minimum additional components required to operate the 1805B for operational checks include: 1) a temperature controlled thermistor mount (such as Weinschel Engineering Model 1109 or 1110); and 2) an RF power source (such as the Weinschel Engineering Model 4372 Synthesized Signal Source). Since the 1805B is only one of the system's required components, complete operating instructions must be considered at the system level. Therefore, Paragraphs 3.3.1 through 3.3.5 contain sufficient information for physically operating the 1805B, but insufficient information information for applying the 1805B to a calibration task. Complete application information for the various system configurations is contained in the *System IIA Automatic Power Meter Calibration System Operation and Service Manual* (IM198).

3.3.1 Operating Precautions

The following precautions must be observed when operating the Model 1805B:

A. Prior to applying power (line voltage) to the 1805B ensure that the line voltage selection and fusing

requirements as outlined in Paragraph 2.4 of this manual have been met.

B. Ensure that all system cabling is correct and secure.

C. Ensure that the environmental temperature within which the system is to function is between +12° and +40°C.

D. Prior to performing calibrations, ensure that the system has experienced the two (2) hour minimum warmup period with the **POWER** switch in the **STANDBY** position (for the first 1 and 1/2 hours) and the **ON** position (for the last 1/2 hour), and the **RF ON/OFF** switch in the **OFF** position.

E. During calibrations, ensure that the **BRIDGE BALANCE** meter is re-zeroed prior to each calibration with the **RF ON/OFF** switch in the **OFF** positin.

3.3.2 Initial Power Application and Checkout Procedures

After installation of the 1805B and all system cabling has been completed, apply power to the 1805B as follows:

A. Ensure that the **RF ON/OFF** switch is in the **OFF** position.

B. Place the **POWER** switch in the **STANDBY** position. (The amber **STANDBY** indicator should illuminate.)

C. After 1 and 1/2 hours of warmup time ensure that the **TEMPERATURE** meter is in the green range, and place the **POWER** switch in the **ON** position. The **STANDBY** indicator should extinguish; the **ON** indicator shoud illuminate; the **RF OFF** indicator should illuminate; the **BRIDGE BALANCE** meter should register a slight deflection; the **TEMPERATURE** meter should remain unchanged (in the green range); and the **ERROR** indicator should NOT illuminate. If the **ERROR** indicator illuminates, attempt to obtain a null reading on the **BRIDGE BALANCE** meter using the **COARSE** and **FINE NULL ADJUST** controls. If the **ERROR** indication persists, then return the **POWER** switch to the **STANDBY** position and check system cabling and thermistor continuity. If, after performing these checks, subsequent power application continues to result in an **ERROR** indication, power should be removed

from the system and the 1805B removed for troubleshooting.)

D. After the system has had the additional 1/2 hour of warmup with the **POWER** switch in the **ON** position, and if all indications are normal (as outlined in Step C above), the 1805B is ready for operation.

3.3.3 Local Control Operation

After installation, cabling, initial power application, checkout, and warmup have been completed, the 1805B may be operated manually (under local control) as follows:

A. Leave the **POWER** switch in the **ON** position.

B. Select the desired dc substituted power level using the **DC SUBSTITUTED POWER** switch.

C. With the **RF ON/OFF** switch in the **OFF** position, use the **COARSE NULL ADJUST** control to obtain a close-to-zero (0) reading on the **BRIDGE BALANCE** meter.

D. Use the **FINE NULL ADJUST** control to obtain a precise zero (0) "null" reading on the **BRIDGE BALANCE** meter.

E. Switch the **RF ON/OFF** switch to the **ON** position. The **RF ON** indicator should immediately illuminate, and the **RF OFF** indicator should immediately extinguish. Additionally, the **BRIDGE BALANCE** meter should momentarily deflect and then quickly revert to zero (indicating a locked condition) where the indicator should remain stable. If the meter remains deflected to the left, increase the RF level provided by the signal generator or decrease the DC Substituted Power setting. If the meter remains deflected to the right, decrease the RF level provided by the signal generator or increase the DC Substituted Power setting. If level control adjustments do not result in a lock,fault isolate the problem using the system-level troubleshooting procedures given in the *System IIA Automatic Power Meter Calibrator System Manual* (IM198). Failure to renull (obtain lock) results in inaccurate calibrations.

F. After the appropriate calibration reading(s) have been taken, switch the **RF ON/OFF** switch to the **OFF** position. (The **RF OFF** indicator should momentarily deflect and then quickly return to zero (indicating a locked condition) where the indicator

should remain stable. If the meter remains deflected to the left, increase the RF level provided by the signal generator or decrease the DC Substituted Power setting. If the meter remains deflected to the right, decrease the RF level provided by the signal generator or increase the DC Substituted Power setting. If level control adjustments do not result in a lock, fault isolate the problem using the system-level troubleshooting procedures given in the *System IIA Automatic Power Meter Calibration System Operation an Service Manual* (IM198). Failure to renull (obtain lock) results in inaccurate calibrations.

G. For subsequent calibrations, repeat Steps B thru F above.

H. When calibrations have all been completed, proceed to Paragraph 3.3.5 of this manual for shutdown instructions.

3.3.4 Remote Operation

The Model 1805B can be remotely controlled over an IEEE-488 bus by a standard bus controller. Connect the controller to the IEEE-488 bus interface connector located on the rear panel according to Paragraph 2.5.1. Set the 1805B's bus address using the rear panel ADDRESS switch according to Paragraph 2.5.2.

The Model 1805B recognizes commands sent via the IEEE-488 in the form of mnemonics composed of a single ASCII character. Table 3-1 lists these mnemonics and provides an explanation of each command. All commands must be terminated by ASCII codes for Line Feed (OA) and/or an EOI with the last character.

For more information on bus structure, management, and terminology, refer to the IEEE Standard 488-1978 "Digital Interface for Programming Instrumentation".

The **REMOTE** indicator is lit when the 1805B is placed into remote mode by the bus controller. When the 1805B is addressed by the bus controller, the **LISTEN** indicator illuminates and stays lit until another device on the bus is addressed. Set the desired DC Substituted Power level using one of the mnemonics listed in Table 3-1. Monitor the 1805B's **BRIDGE BALANCE** meter to ensure that the signal is locked. This is indicated by a momentary deflection of the **BRIDGE BALANCE** meter followed quickly by a return to zero (indicating a locked

condition). If the meter deflection persists, rectify the condition as described in Paragraph 3.3.3. **There is no feedback to the bus controller that signals whether the 1805B is properly locked.**

Table 3-1. MODEL 1805B MNEMONICS FOR REMOTE CONTROL

MNEMONIC	ACTION
0	Sets RF OFF
*	Sets RF ON and DC Substituted Power to .5 mW
1	Sets RF ON and DC Substituted Power to 1 mW
2	Sets RF ON and DC Substituted Power to 2 mW
3	Sets RF ON and DC Substituted Power to 3 mW
4	Sets RF ON and DC Substituted Power to 4 mW
5	Sets RF ON and DC Substituted Power to 5 mW
6	Sets RF ON and DC Substituted Power to 6 mW
7	Sets RF ON and DC Substituted Power to 7 mW
8	Sets RF ON and DC Substituted Power to 8 mW
9	Sets RF ON and DC Substituted Power to 9 mW
X	Sets RF ON and DC Substituted Power to 10 mW

3.3.4.1 SYSTEM II SOFTWARE

Weinschel Engineering markets software to operate the 1805B as part of a System II. This software can be used with a variety of IEEE-488 bus controllers, RF generators, power meters, and voltmeters. The System II software package comes in a number of forms, dependent on the controller used to operate the system. Table 3-2 lists the software packages available for the various controller options.

The main System II software is capable of controlling various devices over the IEEE-488 bus. Compatible RF sources include:

- Weinschel Engineering 4310AK/N
- Weinschel Engineering 4312 System
- Weinschel Engineering 4312A System
- Weinschel Engineering 4370 Series
- EIP 928/931
- Hewlett Packard 8350 Sweep Oscillator
- Hewlett Packard 8340/8341 Synthesized Sweeper
- Wiltron 6600 Series
- Polarad SMS

Table 3-2. CONTROLLER OPTIONS AND AVAILABLE SOFTWARE

CONTROLLER	SOFTWARE ON:	WEINSCHEL ENGINEERING PART NO.:
Hewlett Packard 80 Series Controllers*:		
HP Model 85 Controller	cassette tape	189-3-1
HP Model 86 Controller	3 ½" disc	189-3-2
	5 ¼" disc	189-3-3
Hewlett Packard 9000 Series 200 Controllers: HP Model 216 Controller (9816) HP Model 226 Controller (9826) HP Model 236 Controller (9836)	3 ½" disc	189-3-4
	5 ¼" disc	189-3-5

* full IEEE-488 interface capability

Compatible power meters include:

- Hewlett Packard 436
- General Microwave 475
- Pacific Measurements 1045
- Boonton 4200
- Marconi 6960

When calibrating a thermistor mount (WE Model 1109 or 1110), or when calibrating a power meter without an IEEE-488 interface bus option, it is necessary to use a bus-controlled digital voltmeter. Compatible voltmeters include:

- Fluke 8500 Series
- Hewlett Packard 3455 or 3478
- Keithley 192
- Datron 1065 (not recommended)

3.3.5 Terminating Operation

The following procedures may be used to terminate 1805B operation at any time under either local or remote control:

A. Place (or ensure that) the **RF ON/OFF** switch is in the **OFF** position.

B. Place the **POWER** switch to the:

1. **STANDBY** position (if more calibrations are to be performed and avoiding the warmup period is desired.) Leaving it in the **STANDBY** position allows the temperature of the mount to remain stabilized. The **STANDBY** indicator should illuminate; the

TEMPERATURE meter should stay in the green range; and all other indicators should extinguish.

2. **OFF** position (to terminate all 1805B operation). All indicators should extinguish; the **TEMPERATURE** meter should indicate zero (0) volts; and the **BRIDGE BALANCE** meter should indicate a zero (0) midscale reading.

SECTION 4
PRINCIPLES OF OPERATION

4.1 INTRODUCTION

This section contains information concerning the principles of operation of the Model 1805B RF Control Unit. For a discussion of the principles of operation of the Model 1805B within a power sensor calibration system that is traceable to the National Bureau of Standards, refer to the *System IIA Automatic Power Meter Calibration System Manual* (IM198). Refer to Section 7 of this manual for assembly drawings, schematics and descriptions of individual circuits.

4.2 PRINCIPLE OF DC SUBSTITUTION

The essential purpose for the design of the Model 1805B is to realize the principle of dc substitution. DC substitution generally refers to the measurement of RF power according to the amount of dc power that must be substituted for the RF power in a bolometer in order to cause equivalent thermal effects. More specifically, dc substitution occurs in the 1805B when a dc-biased bridge containing a temperature-sensitive bolometer element becomes unbalanced due to the RF power effect on the bolometer element and balanced due to a substitution or elimination of dc bias that is proportional to the change in the applied RF power.

The Model 1805B design assists in the realization of the principle of dc substitution by precisely controlling the levels of two variables inherent in this theorem. These precisely-controlled variables are the level of RF power applied to the bolometer element and the substituted level of dc bias. The principle of dc substitution extends to the determination of feedthrough thermistor mount calibration factors (K2--the ratio of substituted power to the power incident on

the thermistor mount) by the following formulas:

$$P_{RF_2} = \frac{P_{dc_1}}{K_2}$$

$$K_2 = \frac{P_{dc_1}}{P_{RF_2}}$$

Where:

P_{RF_2} = *the RF power emerging from the feedthrough mount under test,*
P_{dc_1} = *the dc substituted power as set at the Model 1805B,*
K_2 = *the measured or known calibration factor for the feedthrough mount,*

For a complete discussion of the realization of the principle of dc substitution within a power sensor calibration system, refer to *System IIA Automatic Power Meter Calibration System Operation and Service Manual* (IM198).

4.3 RF POWER LEVEL CONTROLLER

The Weinschel Model 1805B RF Control Unit combines with a temperature-stabilized feedthrough thermistor mount and an RF generator to form a closed loop RF control system (shown functionally in Figure 4-1) that achieves precise control of dc substituted power levels. At the core of this system are two thermistor beads with negative temperature coefficients whose resistances total 200 ohms when biased at 30 mW. The temperature-stabilized feedthrough thermistor mount/power splitter contains these thermistor beads.

These thermistor beads, whose resistances decrease as a function of increasing power, comprise a leg of a self-correcting, dc-biased, Wheatstone bridge circuit, which originates in the Weinschel Model 1805B RF Control Unit. When a precise level of dc bias is removed from this bridge circuit by manual or bus-controlled switching of the Model 1805B, an unbalanced bridge condition occurs. The output of this unbalanced bridge is directly related to the precise level of dc bias removed. After amplification and filtering, the voltage output of this unbalanced bridge drives a voltage-controlled attenuator. This component varies the attenuation of RF power incident upon a feedthrough thermistor mount in a manner that makes the RF power proportional to the decrease in dc

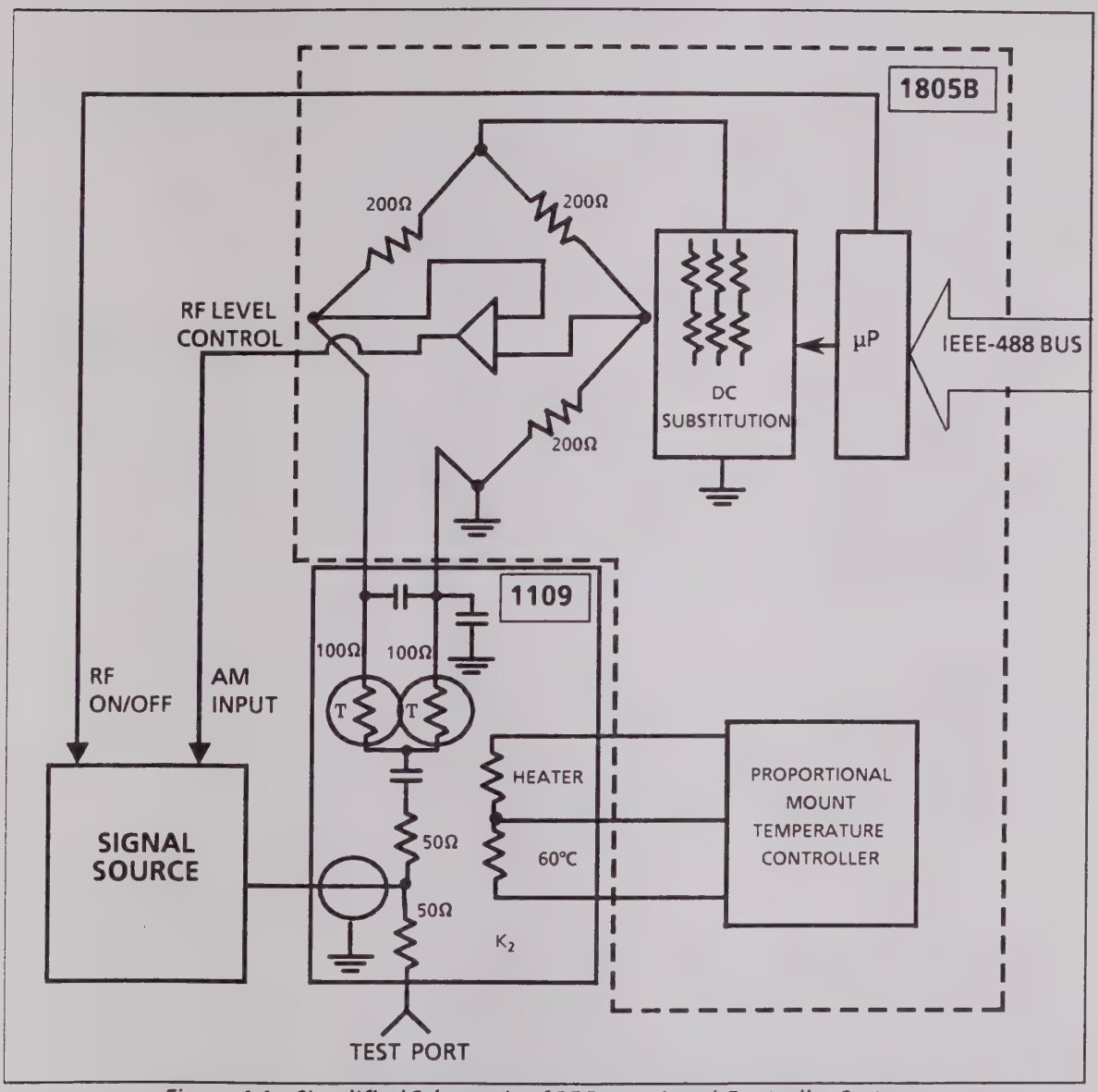


Figure 4-1. Simplified Schematic of RF Power Level Controller System

bias that created the unbalanced condition. Application of the attenuated RF power via one port of a power splitter restores the total 200-ohm bias to the thermistor beads and thus bridge balance. The resistance of the thermistor pair is directly related to the sum of RF power applied from one output port of the power splitter and the dc power from the bridge. Since an equal RF power level is present at the second output port of the power splitter, this port sources a precision level of RF power.

SECTION 5
MAINTENANCE

5.1 INTRODUCTION

This section provides information required to maintain and to service the Weinschel Engineering Model 1805B RF Control Unit and contains troubleshooting procedures, a list of required test equipment, a performance check, a verification and alignment procedure for the temperature control meter and calibration and alignment procedures.

5.2 PREVENTIVE MAINTENANCE

While the Model 1805B requires little preventive maintenance, it should not be subjected to physical abuse, severe mechanical shock, high humidity, or operating temperatures outside the specification range. Keep the 1805B free of excessive dirt and dust for this may interfere with normal heat dissipation and connector functions. Prevent physical strain of the interconnecting cables, as damage here is difficult to detect.

To remove dirt or dust, use a slightly-dampened lint-free cloth. Avoid the use of cleaning solvents. Remove interior dust by using a low-pressure air blower. Occasionally check external cables and connectors for signs of cracked insulation and bent or worn pins. Refer to Appendix A for additional information on care and handling of cable assemblies.

5.3 TROUBLESHOOTING PROCEDURES

Where the 1805B in question is a component of a System II Automatic Power Meter Calibration System, troubleshooting procedures herein assume completion of system-level diagnostics. These diagnostics, which may be found in the System II manual, include instructions on how to overcome the inability to lock the System II's RF Level Control Loop. This problem is demonstrated by an inability to zero the 1805B's **BRIDGE BALANCE** meter. If, upon isolation of system-level flaws, any problem persists, continue with the troubleshooting procedures contained in this manual. These procedures consist of performance testing outlined in Paragraphs 5.5 thru 5.5.5.1 and calibration procedures outlined in Paragraphs 5.6 thru 5.6.6. Inability to resolve the problem through these diagnostics indicates that the problem may originate with associated components such as the feedthrough thermistor mount. In such instances, recheck all cabling instructions and refer to the

maintenance sections of associated components for further diagnostics.

5.4 TEST EQUIPMENT REQUIRED

Table 5-1 lists all test equipment needed to perform all calibration and alignment procedures herein. Test equipment other than that listed in Table 5-1 may be used if their specifications equal or exceed the required specifications.

5.5 PERFORMANCE TESTS

Performance of the tests contained in Paragraph 5.5.1 thru 5.5.5 verifies that the Weinschel Model 1805B is operating within its specifications as listed in Table 1-1. The test could be used as part of an incoming quality control inspection, as a periodic operational check, or after maintenance or service has been performed.

5.5.1 Initial Test Setup

Establish the initial test setup by proceeding with the following steps:

A. Measure the two 100-Ω resistance standards (R_{S1} and R_{S2}) with an ohmmeter and use the following method to obtain the dividing factor (DF):

1. Measure total series resistance of R_{S1} and R_{S2} with an ohmmeter.

2. Measure resistance of R_{S2} with an ohmmeter.

3. Calculate the dividing factor as follows:

$$DF = \frac{R_{S1} + R_{S2}}{R_{S2}}$$

B. Connect the two resistance standards to the 1805B **BIAS MOUNT** terminals (E1 and E2) and DVM terminals as shown in Figure 5-1. Also link the Model 1109 Temperature **CONTROL** connector (J1) to the 1805B Temperature **CONTROL** connector (J1) via a temperature control cable (P/N 138-477).

Table 5-1 REQUIRED TEST EQUIPMENT

EQUIPMENT	RECOMMENDED MODEL
Two DC Multimeters with 2-volt and 6-1/2 digit resolution	
Feedthrough Thermistor Mount: 200-ohm bias at 30 mW	Weinschel Engineering Model 1109 or Model 1807A
RF Generator with a .01-18 GHz range (minimum 13 dBm)	Weinschel Engineering Model 4370
± 5-volt power supply	
20-volt power supply	
Two ammeters with microamp sensitivity	
Two standing wave ratio meters with sensors	
Slotted Line	Weinschel Engineering Model 1024
Two 100-ohm resistance standards	Leeds & Northrup #4030-B
Power sensor head	Hewlett Packard Model 8481A
Power Meter	
10-dB Attenuator	Weinschel Engineering Model 2-10
Amplifier	Weinschel Engineering Model 1725A
IEEE-488 Bus Controller	Hewlett Packard Model 85F

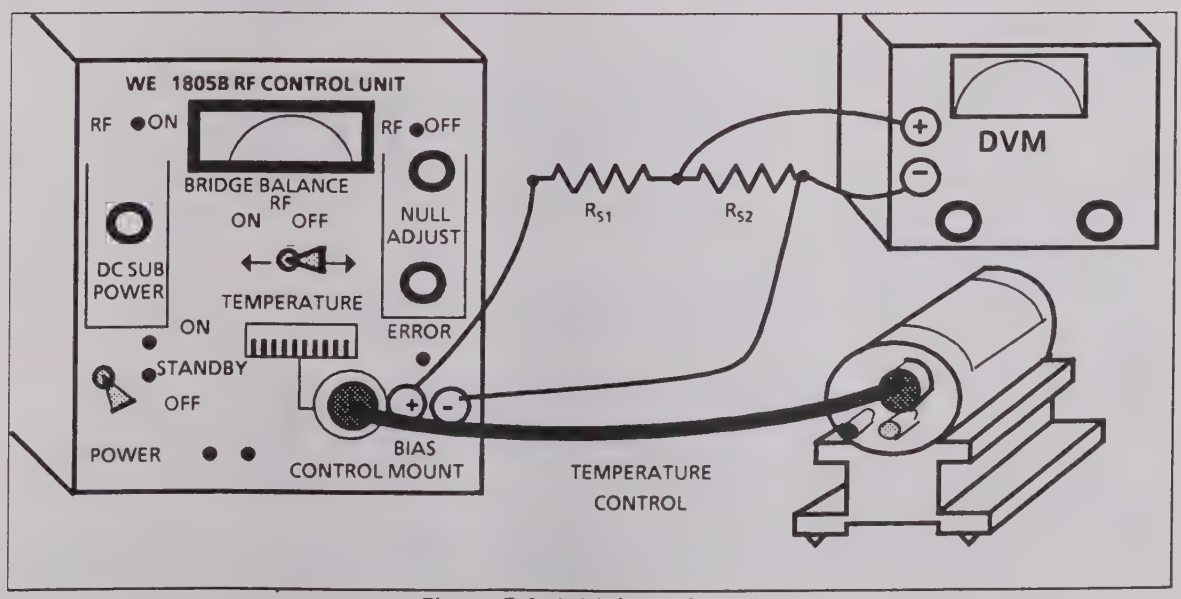


Figure 5-1. Initial Test Setup

C. Set the 1805B **RF ON/OFF** switch (S2), located in the center of the front panel, to the **OFF** position.

D. Turn 1805B **POWER** switch (S1), located on the bottom right side of front panel, to the **STANDBY** and **ON** positions ensuring that the proper LEDs (DS5 or DS4) illuminate. Allow one hour for the feedthrough thermistor mount (W/E Model 1109) to stabilize.

5.5.2 DC Substitution Accuracy Test

To determine the accuracy of dc substituted power levels, retain the initial test setup and proceed with the following steps:

A. Obtain a reading of 1.22474 V ± 10 μV(E_1) on the DVM by adjusting the 1805B **FINE NULL ADJUST** (R1)and **COARSE NULL ADJUST** (R2) knobs on the right front panel.

B. Set the 1805B **RF ON/OFF** switch (S2), located on the center of the front panel, to the **ON** position.

C. Turn the 1805B **DC SUBSTITUTED POWER** switch (S3), located on the left front panel, to each position (.5 and 1-10 mW) and record the voltage on the DVM (E_F) at each setting of the switch.

D. For each dc substituted power setting, calculate the substituted power levels (P_S) using the following formula:

$$P_S(mW) = (E_1^{\,2} - E_F^{\,2}) \frac{DF}{R_{S2}} \times 10^3$$

E. Determine that the calculated substituted power level (P_S) is within ±0.1% of the selected **DC SUBSTITUTED POWER** switch (S3) position. An out-of-tolerance condition indicates need for calibration of the 1805B. Refer to Paragraph 5.6.

5.5.3 Bias Power Range

To check that the 1805B bias power range is within specification, proceed with the following steps:

A. Set the 1805B **RF ON/OFF** switch to the **OFF** position. Set the 1805B **FINE NULL ADJUST** (R1) and **COARSE NULL ADJUST** (R2) knobs fully clockwise and record the DVM reading (E_1).

B. Set the **FINE NULL ADJUST** (R1) and **COARSE NULL ADJUST** (R2) knobs fully counterclockwise and record the DVM reading (E_2).

C. Calculate the bias power range using the following formula:

$$P_{BIAS\ MIN} = \frac{(E_1)^2}{100\ \Omega} \text{ and } P_{BIAS\ MAX} = \frac{(E_2)^2}{100\ \Omega}$$

D. Ensure that the calculated bias power range meets specifications, i.e., the minimum bias power is less than 29 mW and the maximum bias power is greater than 31 mW. An out-of-range condition should light the front panel **ERROR** indicator DS3 and indicates a need for calibration. Refer to Paragraph 5.6.

5.5.4 Temperature Control Circuit Verification

To verify the performance of the 1805B temperature control circuit, monitor the **TEMPERATURE** Control Meter (M2) located on the lower center of the front panel. When a cold thermistor mount is first connected to the 1805B and the 1805B is in **POWER STANDBY** mode, the needle of the **TEMPERATURE** Control Meter should provide an approximate full-scale reading (9.2 to 10.2). Once the mount has been heated by the 1805B's temperature controller for a period of one hour, the needle should not vibrate and should remain well within the green shaded area of the **TEMPERATURE** Control Meter. If the **TEMPERATURE** Control Meter fails to perform as indicated, the temperature control circuit requires adjustment. Refer to Paragraph 5.6.6 and perform the **TEMPERATURE** Control Meter alignment procedures.

5.5.5 System II Closed Loop Stability Test

Figure 5-3 illustrates the step-by-step procedure to check the closed loop stability of the System II precision source subsystem, which is composed of a signal generator, a Model 1805B, and a Model 1807A RF Transfer Standard or Model 1109 Feedthrough Thermistor Mount. Table 5-1 includes recommendations for suitable instruments to perform this test. The amplifier used in this procedure is required to obtain system lock at higher 1805B dc substitution power settings. This test may be easily automated by use of an optional IEEE-488 bus controller if software is provided by the user. Figure 5-3 can act as a flowchart upon which to base such software. A hard copy of data associated with stability failures may be obtained by connection of a printer to the bus controller or use of a bus controller with an internal printer. Figure 5-2 depicts a block diagram representation of the setup for this test. Refer to Paragraph 5.5.5.1 for further test setup details.

In the event that the system fails the Closed Loop Stability Test, the problem probably lies in the 1805B's RF Amplifier Board. Refer to the RF Amplifier Board calibration procedure in Paragraph 5.6.5. If the test fails subsequent to calibration, troubleshoot the board for component failures or consult the factory.

5.5.5.1 CLOSED LOOP STABILITY TEST SETUP

Figure 5-2 is a block diagram that illustrates the test setup for the Closed Loop Stability Test. To accomplish this setup, perform the following steps:

A. Connect the RF output of the frequency generator (such as the Weinschel Engineering Model 4370) to the input of an amplifier (such as the Weinschel Engineering Model 1725A).

B. Connect the output of the amplifier to the **RF IN** connector of 1109 or 1807A.

C. Connect the 1805B's red and black **MOUNT BIAS** connectors (E1 and E2) to the feedthrough thermistor mount's Mount Bias inputs (on the 1109 - J2 and J3; on the 1807A - **MOUNT BIAS** connectors J3 and J4).

D. Connect the 1805B's Temperature **CONTROL** output J1 to the Feedthrough Thermistor Mount's Temperature Control inpuit (on the 1109, link to Temperature Control connector J1; on the 1807A, link to the **MOUNT HEATERS** connector J9).

E. Connect a 10-dB attenuator (such as the Weinschel Engineering Model 2-10) to the RF output of the thermistor mount (on the 1109, link the attenuator to its test port; on the 1807A, link the attenuator to its front panel **TEST PORT** J5).

F. Connect the opposite end of the 10-dB attenuator to the input of a power sensor head (such as the HP 8481A).

G. Connect the output of the power sensor head to a power meter.

H. If desired, bus the frequency source, amplifier, power meter, and the 1805B to an IEEE-488 bus controller and control the procedure remotely. If desired, connect a printer to the bus controller to obtain a hard copy of the dc substituted power and frequency levels at which variances in the stability test occurs.

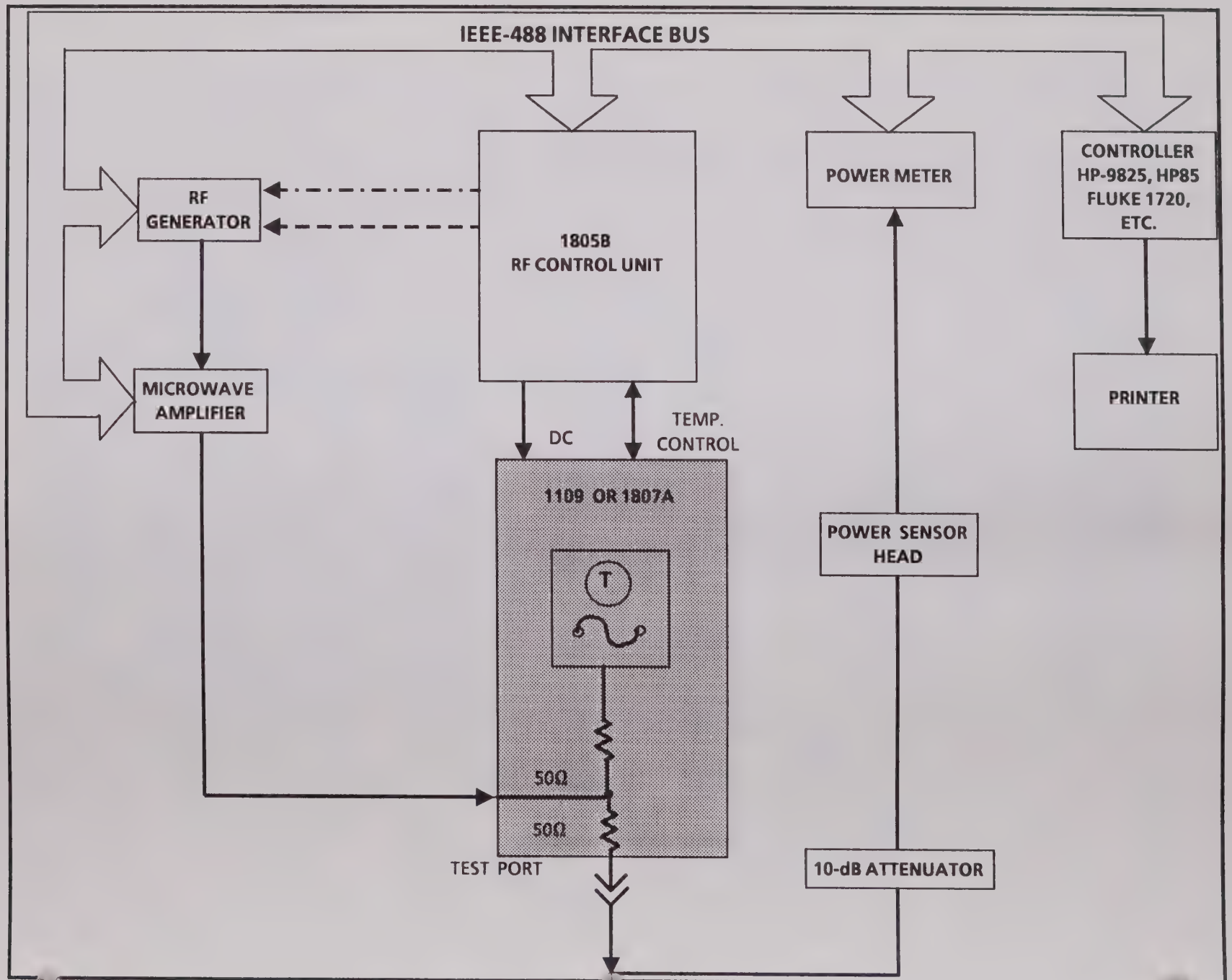


Figure 5-2. System II Closed L[illegible] Stability Test, Block Diagram

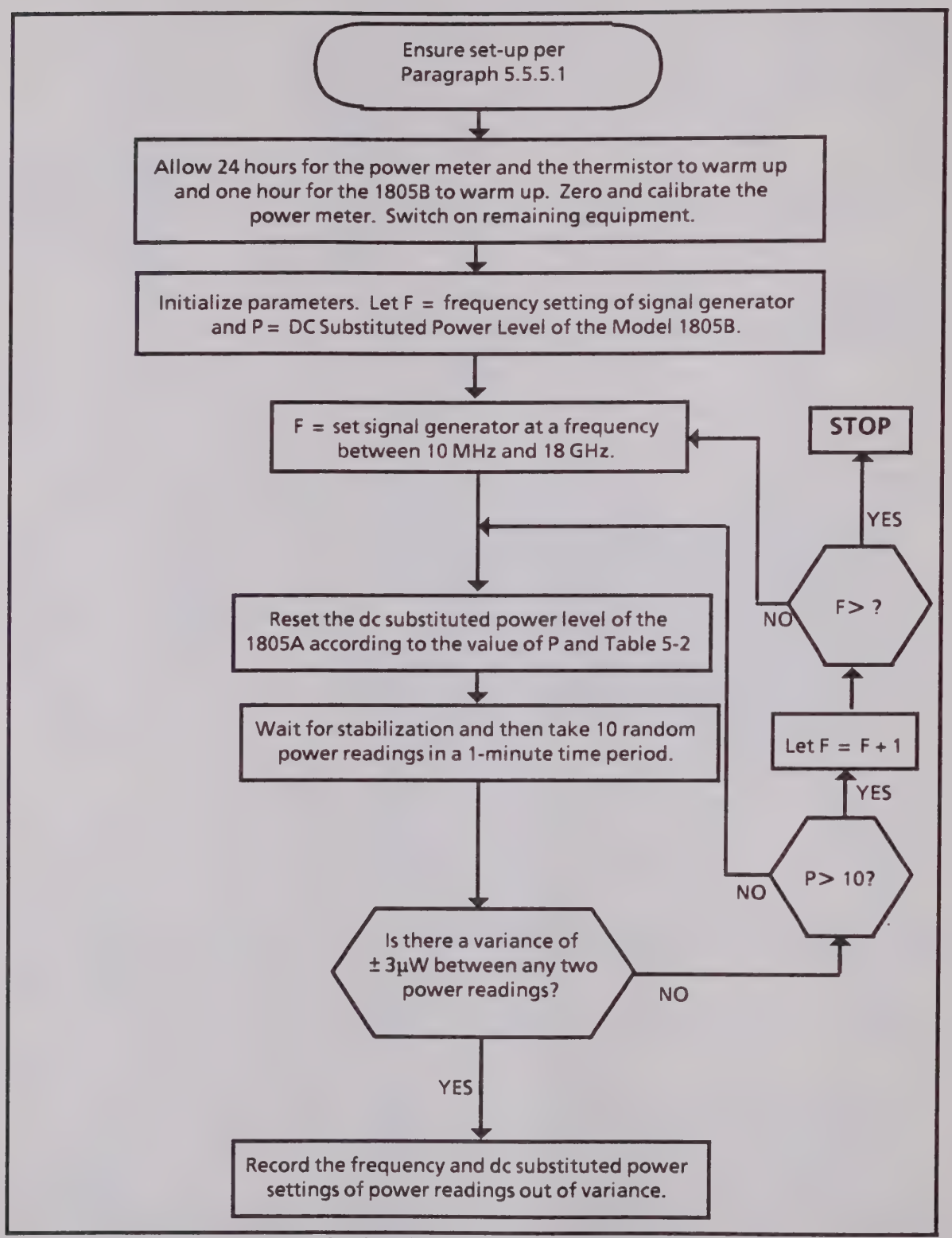

Ensure set-up per Paragraph 5.5.5.1
Allow 24 hours for the power meter and the thermistor to warm up and one hour for the 1805B to warm up. Zero and calibrate the power meter. Switch on remaining equipment.
Initialize parameters. Let F = frequency setting of signal generator and P = DC Substituted Power Level of the Model 1805B.
F = set signal generator at a frequency between 10 MHz and 18 GHz.
STOP
YES
F> ?
NO
Reset the dc substituted power level of the 1805A according to the value of P and Table 5-2
Wait for stabilization and then take 10 random power readings in a 1-minute time period.
Let F = F + 1
YES
P> 10?
NO
Is there a variance of ± 3μW between any two power readings?
NO
YES
Record the frequency and dc substituted power settings of power readings out of variance.

Figure 5-3. Closed Loop Stability Test Procedure

Table 5-2. DC SUBSTITUTED POWER SETTINGS FOR CLOSED LOOP STABILITY TEST

P	1805B SETTING
0	0.5 mW
1	1 mW
2	2 mW
3	3 mW
4	4 mW
5	5 mW
6	6 mW
7	7 mW
8	8 mW
9	9 mW
10	10 mW

5.6 CALIBRATION PROCEDURES

If the Model 1805B fails the foregoing performance tests, proceed with all the calibration procedures in Paragraphs 5.6.1 thru 5.6.6. These procedures involve five assemblies: the 30-Volt Power Supply, the Motherboard Power Supply, the RF Amplifier Board, the DC Substitution Board, and the temperature control circuit. Perform the pescribed preliminary calibration procedures and begin calibrations by measuring the accuracy of the 30-Volt reference and the motherboard power supplies since a misaligned power supply will affect other calibrations. Next perform dc substitution board alignment. This will ensure accurate null adjustments in later calibrations.

5.6.1 Preliminary Calibration Procedures

To perform the preliminary calibration procedures perform the following steps:

A. Remove the top cover of the Model 1805B.

B. Connect the Model 1109, the DVM, the Model 1805B, and two 100 ohm resistance standards as described in Paragraph 5.5.1 and shown in Figure 5-1.

5.6.2 30-Volt Reference Alignment

To align the 30-volt reference, perform the following steps:

A. Connect the DVM across TP3 and TP4 of the DC Substitution board in accordance with Figure 5-4. Refer to Figure 7-7 for test point locations.

B. Adjust trim potentiometer A7R2 on the 30-Volt Power Supply board to obtain a reading of 30.0 V ± .001 V on the DVM. Refer to Figure 7-15 for location of trim potentiometer A7R2.

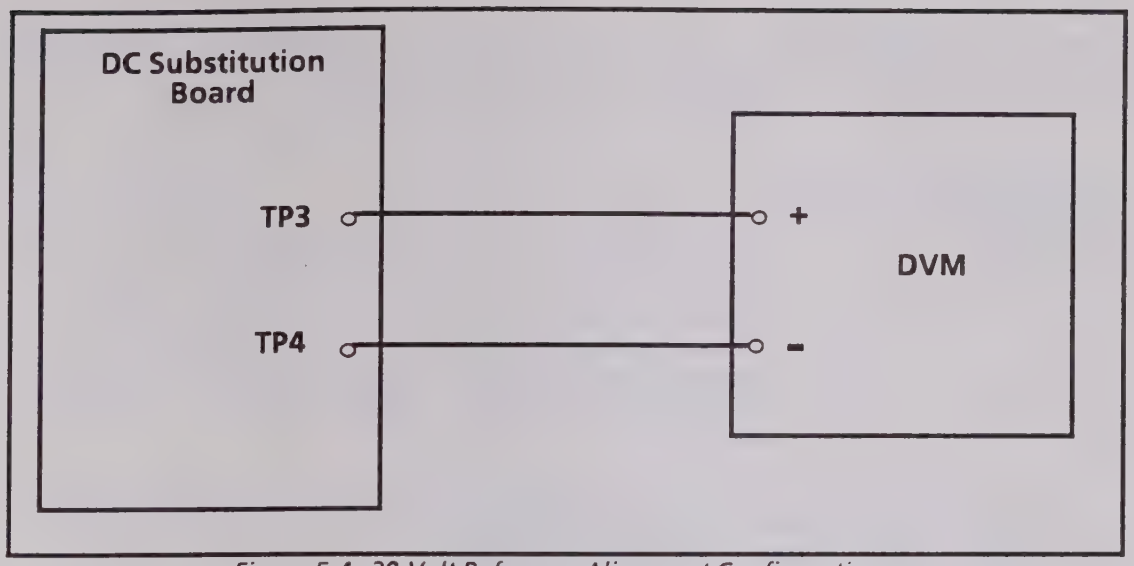


Figure 5-4. 30-Volt Reference Alignment Configuration

5.6.3 Motherboard Power Supply Test

Connect a DVM across the motherboard test points indicated in Table 5-3 to ensure that the voltage output accuracy, voltage ripple, and load regulation under the provided load conditions are present in accordance with Table 5-3. Refer to Figures 7-13 for the location of motherboard power supply test points and Figure 7-15 for the location of the +30-Volt power supply test points.

Table 5-3. MOTHERBOARD POWER SUPPLY CHECK

DVM CONNECTIONS (TP/TP)	VOLTAGE OUTPUT	I_L	V_{RIPPLE}	LINE REGULATION
6/7	+5 ±0.2 V	900 ma	≤5 mV	Δ 50 mV
1/2	+15 ±0.6 V	100 ma	≤5 mV	Δ 10 mV
3/2	-15 ±0.6 V	100 ma	≤20 mV	Δ 10 mV
5/4	+20 ±0.6 V	500 ma	≤5 mV	Δ 100 mV
3*/4*	+30 ±0.001 V	100 ma	≤5 mV	

* DC Substitution Board

5.6.4 D.C. Substitution Board Calibration

Calibration of the dc substitution board consists of three steps: 1) a check of the error reference voltage; 2) an adjustment of the bridge circuitry; and 3) a recheck of the accuracy of dc substitution and the bias power range.

5.6.4.1 CHECK OF ERROR REFERENCE VOLTAGE

The dc substitution board ensures that the feedthrough mount's 30-mW operating requirement is achieved within a tolerance of ± 0.7mW. It does this by comparing the sensed potential found across the thermistor to two reference voltages equivalent to those required to produce this operating range. To check these two reference voltages, refer to Figure 7-7 and 7-8 and perform the following steps:

A. Connect DVM terminals to TP3 and TP6 on the dc substitution board and ensure a DVM reading 2.490V +25 mV.

B. Connect DVM terminals to TP3 and the junction of R31 and R35 and ensure a DVM reading of 2.408 -24 mV. If unable to obtain this reading, adjust R34.

5.6.4.2 BRIDGE CIRCUITRY ALIGNMENTS

To perform alignment of the bridge circuitry perform the following steps:

A. Resume initial test setup described in Paragraph 5.5.1 and pictured in Figure 5-1.

B. Obtain a DVM reading of 1.22474 V ±10 μV across the resistance standard by adjusting the **FINE NULL ADJUST** (R1) and **COARSE NULL ADJUST** (R2) knobs.

C. Switch a DVM to the lowest scale and (referring to Figure 7-7) connect it across TP7 and TP8 on the dc substitution board. Obtain a null reading on the DVM by adjusting the 50-kΩ potentiometer R44.

5.6.4.3 RECHECK OF DC SUBSTITUTION ACCURACY AND BIAS POWER RANGE

After checking the error reference voltage and realigning the bridge circuitry, recheck the accuracy of dc substitution and bias power range according to Paragraphs 5.5.2 and 5.5.3.

5.6.5 RF Amplifier Board Calibration

This section contains information concerning calibration of circuitry that senses the Wheatstone bridge imbalance to drive the **BRIDGE BALANCE** meter(M1).

5.6.5.1 BRIDGE BALANCE METER (M1) CALIBRATION

To perform alignment of the circuitry that drives the **BRIDGE BALANCE** meter, refer to Figure 7-11 and proceed with the following steps:

A. Remove the DC Substitution board (A2) from its motherboard connection (XA2).

B. Remove all external connections except the power cord.

C. Remove the RF Amplifier board (A3) from its motherboard connection (XA3) and replace it with the extender board. Insert the RF Amplifier board into extender board slots.

D. Make the following RF Amplifier board test point connections:

1. TP8 to TP9
2. TP8 to TP6

E. Set DVM scale for better than 1 μV sensitivity.

F. Connect the DVM across TP11 and TP6 on the RF Amplifier board.

G. Ensure that the **RF** switch is turned to the **OFF** position and turn 1805B front panel **POWER** switch (S1) to the **ON** position. Allow a five-minute warm-up period.

H. Adjust potentiometer R22 to obtain a 0 V ±10 mV DVM reading.

I. Adjust potentiometer R45 counterclockwise for maximum resistance. Shift calibration jumper SJ1 from its operation position (between pins 1 and 2) to its calibration position (between pins 1 and 3).

J. Connect DVM across resistor R29.

K. Adjust potentiometer R25 to obtain a 0 V ±50 mV DVM reading.

L. Connect a 2.7-MΩ resistor and a series switch across dc substitution board connectors E3 and E4 (refer to Figure 7-7) to obtain a 5 μW offset. Open series switch.

M. Replace DC Substitution Board to its motherboard connector (XA2) and disconnect test point connections made in Step D.

N. Connect 1109 Feedthrough Thermistor Mount's or the 1807A's positive and negative Mount Bias connectors to the 1805B front panel positive and negative **BIAS MOUNT** connectors (E1 and E2, respectively).

O. Ensure that the **RF** switch is turned to the **OFF** position and turn the front panel **POWER** switch (S1) to the **ON** position and allow a five-minute warm-up period.

NOTE

Mount requires one-hour warm-up period for stability.

P. Rotate **FINE NULL ADJUST** (R1) and **COARSE NULL ADJUST** (R2) controls in order to obtain a −2.5 μW reading on **BRIDGE BALANCE** meter.

Q. Close the series switch installed across dc substitution board connectors E3 and E4.

R. Adjust potentiometer R45 on the RF Amplifier board to obtain a +2.5 μW reading on **BRIDGE BALANCE** meter (M1).

S. Open the series switch installed across E3 and E4 of the dc substitution board.

T. If **BRIDGE BALANCE** meter reading is 2.5 μW ±.25 μW, calibration of the bridge balance meter is complete. If not, repeat Steps Q thru T until such a reading is obtained.

U. Remove the extender board and return the DC Substitution board (A2) and the RF Amplifier board (A3) to their respective motherboard connections (XA2 and XA3, respectively). Return calibration jumper SJ1 to its operation position between pins 1 and 2.

5.6.6 Temperature Control Meter Alignment

If a full-scale reading cannot be obtained on the **TEMPERATURE** Control Meter during initial warm-up or if the needle does not remain stable and well within the green region of the meter after the mount has been heated for one hour, the **TEMPERATURE** Control Meter requires adjustment. Consult the referenced illustrations in Section 7 of this manual and proceed according to the following steps:

A. Remove two screws located at the rear of the top cover and remove the top cover by sliding it toward the rear.

B. Referring to Figure 6-1, remove the RF Amplifier board (A3) from its motherboard connection. In its place, insert the extender board assembly (A5).

C. Insert the RF Amplifier board into the extender board assembly.

D. Construct a test fixture using the parts in Table 5-4 and following the schematic shown in Figure 5-5. Connect the test fixture to the temperature **CONTROL** connector located on the front panel of the Model 1805B using the temperature control cable (W/E Part No. 138-477) provided with the Model 1805B. Insert the connectors as keyed and tighten down the knurled ring.

Table 5-4. 1805B TEMPERATURE CONTROL METER TEST FIXTURE PARTS LIST

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
J1	CONN PLUG 4 CONTACTS	062-117	91-MC4F1	52500
R1	RES WW 50Ω 5W 5%	026-6-50	RS-5-50-5	91637
R2	RES WW 50Ω 5W 5%	026-6-50	RS-5-50-5	91637
R3	RES WW 50Ω 5W 5%	026-6-50	RS-5-50-5	91637
R4	RES WW 50Ω 5W 5%	026-6-50	RS-5-50-5	91637
R5	POT COMP 2500Ω 2W	020-33	CU-2521	44655
1	KNOB BLACK AND SILVER	071-19	DS-90-1-2	49956

E. Referring to Figure 7-11, connect the positive lead of a digital voltmeter to the RF Amplifier board at the emitter of Q2 (bottom of R16).

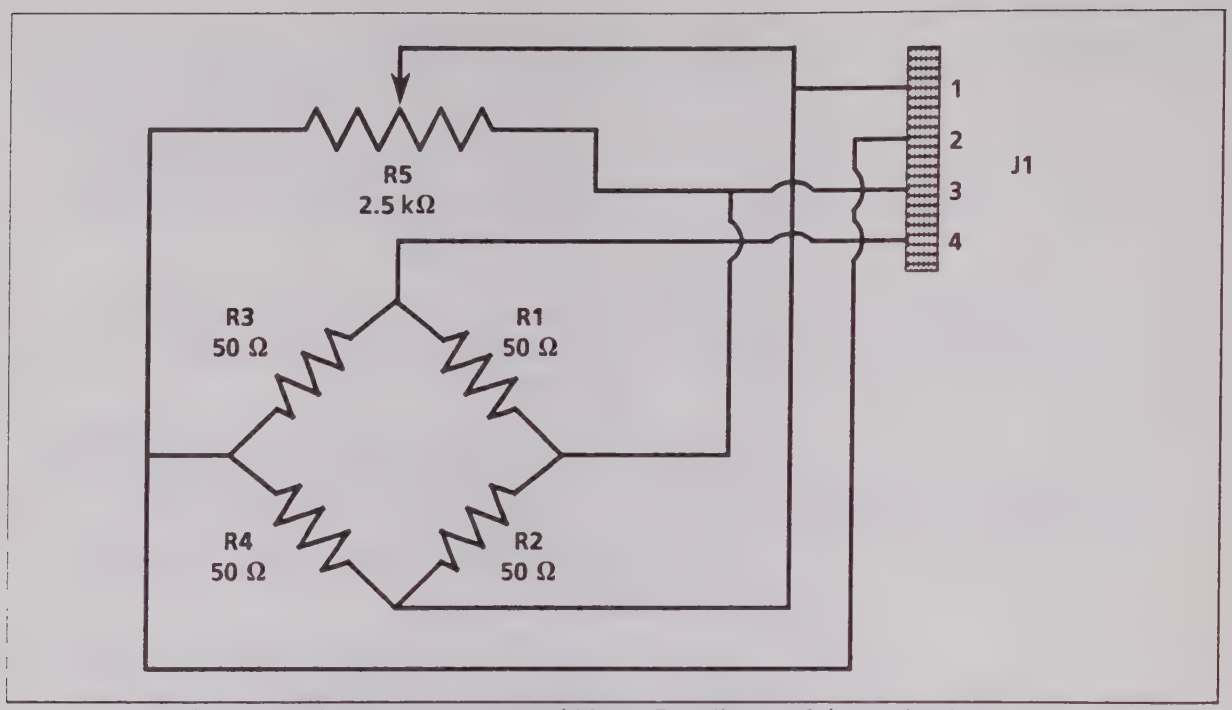


Figure 5-5. Temperature Control Meter Test Fixture, Schematic Diagram

F. Referring again to Figure 7-11, connect the positive lead of a digital voltmeter to the RF Amplifier board at the emitter of Q3 (top of R16).

G. Set the digital voltmeter to measure voltage in the millivolt range.

H. Switch the Model 1805B **POWER** switch to the **STANDBY** position.

I. Turn the control potentiometer on the test fixture clockwise until the maximum deflection of the **TEMPERATURE** Control Meter is observed (as indicated by a reading of greater than 200 mV on the digital voltmeter).

J. Switch the Model 1805B **POWER** switch to the **OFF** position.

K. Referring to Figure 7-11, remove resistor R17 and install a decade resistance box in its place. Set the decade resistance box for 27 kilohms.

L. Set the Model 1805B **POWER** switch to the **STANDBY** position.

M. Set the control potentiometer fully clockwise on the test fixture to produce a maximum deflection of the needle on the **TEMPERATURE** Control Meter.

N. Adjust the decade resistance box so that the **TEMPERATURE** Control Meter indicates an approximate full-scale reading of between 9.6 and 10 and note the setting of decade resistance box.

O. Install a resistor for R17 having the same resistance value as found in step N. This resistor should be rated for 1/4 watt and have a tolerance of 5%.

P. Reinstall the RF Amplifier board by reversing steps A thru C.

Q. Connect the thermistor mount to the 1805B's temperature **CONTROL** connector and allow one hour for warm-up. During the initial warm-up period, the **TEMPERATURE** Control Meter should deflect fully to the right. After one hour warm-up period the needle of the **TEMPERATURE** Control Meter should remain well within the shaded green area and not vibrate. If this condition does not prevail, the temperature contol circuit is faulty.

5.7 CONTACTING WEINSCHEL ENGINEERING

In the event of an instrument malfunction, contact Weinschel Engineering. An apparent malfunction of an instrument or component may be corrected over the phone by first contacting the Customer Service Department at Weinschel Engineering. Do not send the instrument or component back to the factory without prior authorization. When it is necessary to return an item, state the symptoms, catalog and type number of the instrument or component, and date of original purchase. Also write the Company name and your name and phone number on a card and tape the card to the item returned. Paragraph 2.6 provides further information regarding preparation for reshipment.

Contact Weinschel Engineering via mail, telephone, wire, or cable at:

Via mail: Lucas Weinschel
P.O. BOX 6001
One Weinschel Lane
Gaithersburg, MD 20884-6001
U.S.A.

Via Telex: 440702

Via Telefax: 301-948-3625

Via Phone: Call TOLL FREE 800-638-2048
toll call # 301-948-3434

When exchanging a failed part, provide an estimation of the number of hours the Model 1805B was operated prior to the failure of the part.

SECTION 6
REPLACEABLE PARTS

6.1 INTRODUCTION

This section provides information on the assemblies and replaceable parts of the Model 1805B RF Power Level Control Unit. Tables 6-1 thru 6-9 are a list of Model 1805B replaceable parts. These tables provide reference designations, descriptions, Weinschel part numbers, and manufacturer codes for all Model 1805B components. The information herein allows procurement of major assemblies, subassemblies, or individual component parts.

6.2 REFERENCE DESIGNATIONS

All subassemblies and electrical parts are identified by a standard reference designation (resistor R1, for example) in the parts list, on the component location drawing, and on the schematic diagram. Every parts list contains, in its title, the reference designation of the assembly or subassembly to which the list applies. To speed the location of a particular part, this prefix is omitted from the reference designators in the list, since it it is common to all parts in that list. To form a complete reference designator simply add the parts list assembly designator (A2, for example) to the component designator (R1, for example) to form a complete reference designator (in this case, A2R1).

6.3 ORDERING INFORMATION

The following information should be included when ordering replacement parts:

1. Weinschel Engineering part number and description of part,

2. Instrument model and serial number, and

3. If ordering a part not included in the Replaceable Parts Lists, include:

   a. complete description of the part,
   b. function of the part, and
   c. location of part within equipment.

TABLE 6-1. MODEL 1805B OVERALL ASSEMBLY, 138-415-1, REV. B

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
A1	ASSY PC BD MICROPROCESSOR	138-398		93459
A2	ASSY PC BD DC SUBSTITUTION	138-400		93459
A3	ASSY RF POWER BD	138-449		93459
A4	NOT USED			
A5	ASSY EXTENDER BD	138-417		93459
A6	ASSY MOTHER BD POWER SUPPLY	138-404		93459
A7	ASSY POWER SUPPLY +30V	138-419		93459
A8	ASSY FRONT PANEL	138-394-1		93459
A9	ASSY PANEL REAR	138-467-1		93459
1	ASSY CABLE	138-476-2		93459
2	ASSY CABLE	138-476-3		93459
3	ASSY CABLE 1805A MOUNT BIAS	138-526		93459
4	ASSY TEMPERATURE CONTROL CABLE	138-477		93459
5	ASSY REMOTE PROGRAM CABLE	138-490-1		93459
6	ASSY REMOTE PROGRAM CABLE	138-490-2		93459
7	ASSY BNC CABLE AM MODULATION	138-492		93459
8	CORD POWER 10A-125V	068-21	17250	16428
9	ASSY CABLE ADDRESS SWITCH	138-413		93459
10	ASSY CABLE BAND SELECT	138-552		93459

TABLE 6-2. MICROPROCESSOR P.C. BD. ASSY., A1, 138-398, REV. D

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
C1	CAP MICA 33PF 500V 5%	034-29-330	CD6ED330J03	88124
C2	CAP MICA 33PF 500V 5%	034-29-330	CD6ED330J03	88124
C3	CAP TANT 10.0UF 20V 10%	031-111-106	T368B106K020AS	05397
C4	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C5	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C6	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C7	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C8	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C9	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C10	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
CR1	DIODE GENERAL PURPOSE	012-51	1N3064	81349
CR2	DIODE GENERAL PURPOSE	012-51	1N3064	81349
CR3	DIODE GENERAL PURPOSE	012-51	1N3064	81349
DS1	DIODE LED RED W/RESISTOR	012-314	HLMP-6620	28480
J1	NOT USED			
J2	HEADER 16 PIN	062-242	87586-4	00779
J3	HEADER 24 PIN	062-243	87586-8	00779
R1	RES CARBON COMP 10K 1/4W 5%	025-25-10K	RC07GF103J	81349
R2	RES CARBON COMP 33K 1/4W 5%	025-25-33K	RC07GF333J	81349
R3	RES CARBON COMP 100K 1/4W 5%	025-25-100K	RC07GF104J	81349
TP1	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP2	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP3	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
U1	IC MICROPROCESSOR	015-12-8085	P8085A-2	34649
U2	IC 2K E PROM I/O	015-12-8755	C8755A	34649
U3	IC GPIB TALKER LISTENER	015-12-8291	P8291A	34649
U4	IC TRANSCEIVER	015-02-3447	MC3447P	04713
U5	IC TRANSCEIVER	015-02-3447	MC3447P	04713
U6	IC TRANSISTOR ARRAY DARLINGTON	015-09-75468	SN75468N	01295
U7	IC PROGRAM PERIPHERAL IF	015-12-8255	P8255A	34649
U8	IC TRANSISTOR ARRAY DARLINGTON	015-09-75468	SN75468N	01295
U9	RES NETWORK 10 PIN SIP 4700 2%	028-09-472	4310R-101-472	80294
U10	RES NETWORK 8 PIN SIP 4700 2%	028-07-472	4308R-101-472	80294
U11	RES NETWORK 8 PIN SIP 4700 2%	028-07-472	4308R-101-472	80294
U12	IC QUAD 2-INPUT NAND GATE	015-10-00	SN74LS00N-00	01295
Y1	CRYSTAL 6.144 MHZ	012-364	MP061	11236

TABLE 6-3. DC SUBSTITUTION P.C. BD. ASSY., 139-400, REV. G

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
C1	CAP CER 1UF 50V 10%	034-28-105	CK06BX105K	56289
C2	CAP CER .22UF 50V 10%	034-28-224	CK06BX224K	56289
C3	CAP MICA 470PF 100V 5%	034-29-471	CD7FA471J03	88124
C4	CAP MICA 470PF 100V 5%	034-29-471	CD7FA471J03	88124
C5	CAP CER 1UF 50V 10%	034-28-105	CK06BX105K	56289
C6	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C7	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C8	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C9	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C10	CAP TANT 1UF 20V 20%	031-84	150D105X0020A2	56289
C11	CAP TANT 1UF 20V 20%	031-84	150D105X0020A2	56289
C12	CAP TANT 1UF 20V 20%	031-84	150D105X0020A2	56289
C13	CAP TANT 1UF 20V 20%	031-84	150D105X0020A2	56289
CR1	REFERENCE DIODE VOLTAGE REG	015-07-LM113	LM113H	12040
CR2	REFERENCE DIODE VOLTAGE REG	015-07-LM113	LM113H	12040
DS1	DIODE LED RED W/RESISTOR	012-314	HLMP-6620	28480
DS2	NOT USED			
DS3	DIODE LED RED W/RESISTOR	012-314	HLMP-6620	28480
J1	CONN HEADER RT ANGLE 2 PIN	062-208-2	87632-2	00779
K1	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K2	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K3	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K4	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K5	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K6	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K7	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K8	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K9	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K10	RELAY REED SINGLE POLE	047-34	MRB1A05	04671
K11	NOT USED			
K12	RELAY DOUBLE POLE	047-38	MRB1N05	04671
Q1	TRANSISTOR NPN	012-291	2N2222A	81349
Q2	TRANSISTOR	012-139	2N4401	81349
Q3	TRANSISTOR	012-139	2N4401	81349
Q4	TRANSISTOR	012-139	2N4401	81349
R1	RES PREC 11816.62 .75W .01%	025-37-26	RCK0411816.62	60148
R2	RES PREC 6038.94 .75W .01%	025-37-23	RCK046038.94	60148
R3	RES PREC 4112.51 .75W .01%	025-37-32	RCK044112.51	60148
R4	RES PREC 3149.00 .75W .01%	025-37-17	RCK043149.00	60148
R5	RES PREC 2570.72 .75W .01%	025-37-14	RCK042570.72	60148
R6	RES PREC 2185.06 .75W .01%	025-37-13	RCK042185.06	60148
R7	RES PREC 1909.51 .75W .01%	025-37-11	RCK041909.51	60148
R8	RES PREC 1702.78 .75W .01%	025-37-10	RCK041702.78	60148
R9	RES PREC 1541.95 .75W .01%	025-37-9	RCK041541.95	60148
R10	RES PREC 1474.22 .75W .01%	025-37-8	RCK041474.22	60148
R11	RES PREC 3049.29 .75W .01%	025-37-16	RCK043049.29	60148
R12	RES PREC 3214.17 .75W .01%	025-37-18	RCK043214.17	60148
R13	RES PREC 3605.70 .75W .01%	025-37-19	RCK043605.70	60148
R14	RES PREC 4109.01 .75W .01%	025-37-20	RCK044109.01	60148
R15	RES PREC 4780.00 .75W .01%	025-37-21	RCK044780.00	60148
R16	RES PREC 5719.24 .75W .01%	025-37-22	RCK045719.24	60148
R17	RES PREC 7127.93 .75W .01%	025-37-24	RCK047127.93	60148
R18	RES PREC 9475.50 .75W .01%	025-37-25	RCK049475.50	60148
R19	RES PREC 14170.23 .75W .01%	025-37-27	RCK0414170.23	60148
R20	RES PREC 28253.29 .75W .01%	025-37-28	RCK0428253.29	60148
R21	RES PREC 2900.90 .75W .01%	025-37-15	RCK042900.90	60148
R22	RES PREC 1413.28 .75W .01%	025-37-7	RCK041413.28	60148
R23	RES PREC 100000.00 .75W .01%	025-37-29	RCK04100000.00	60148
R24	RES PREC 1.2K 1.5W .01%	025-37-47	RCK061200.00	60148
R25	RES PREC 200 .75W .01%	025-37-1	RCK04200.00	60148
R26	RES PREC 200 .75W .01%	025-37-1	RCK04200.00	60148
R27	RES PREC 200 .75W .01%	025-37-1	RCK04200.00	60148
R28	RES PREC 2000.00 .75W .01%	025-37-12	RCK042000.00	60148

TABLE 6-3. DC SUBSTITUTION P.C. BD. ASSY., 138-400, REV. G

-CONTINUED-

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
R29	RES PREC 1000.00 .75W .01%	025-37-4	RCK041000.00	60148
R30	RES PREC 952.40 .75W .01%	025-37-3	RCK04952.40	60148
R31	RES METALFILM 324 1/4W 1%	025-33-3240	C4324R 1%	14674
R32	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R33	RES METALFILM 681K 1/4W 1%	025-33-6813	C4681K 1%	14674
R34	POT 2K OHM	020-176-2000	94-9-132-202	16556
R35	RES METALFILM 7150 1/4W 1%	025-33-7151	C47.15K 1%0	14674
R36	RES METALFILM 18.2K 1/4W 1%	025-33-1822	C418.2K	14674
R37	RES METALFILM 1470 1/4W 1%	025-33-1471	C41.47K 1%	14674
R38	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R39	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%22J	14674
R40	RES METALFILM 6190 1/4W 1%	025-33-6191	C46.19K 1%	14674
R41	RES METALFILM 2K 1/4W 1%	025-33-2001	C42K 1%	14674
R42	RES METALFILM 31.6K 1/4W 1%	025-33-3162	C431.6K 1%	14674
R43	RES WW 1 1W 1%	026-67-1	RS-1A-1-1	91637
R44	POT 50K OHM	020-176-50K	94-9-132-503	16556
R45	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
R46	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
R47	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
R48	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
U1	IC DUAL OP AMP	015-07-LM358H	LM358H	12040
U2	IC VOLTAGE COMPARATOR/BUFFER	015-07-LM319	LM319H	12040
U3	IC OPTIBLE COUPLED ISOLATOR	015-07-4351	6N136	28480
U4	IC MONOSTABLE/ASTABLE MULTIVIB	015-01-4047	CD4047BE	86684

TABLE 6-4. RF AMPLIFIER P.C. BD. ASSEMBLY, A3, 138-449, REV. M

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
C1	CAP CER 1UF 50V 10%	034-28-105	CKO6BX105K	56289
C2	CAP CER 1UF 50V 10%	034-28-105	CKO6BX105K	56289
C3	CAP TANT 1.0UF 35V 10%	031-112-105	T368A105KO35AS	05397
C4	CAP TANT 1.0UF 35V 10%	031-112-105	T368A105KO35AS	05397
C5	CAP CER .22UF 50V 10%	034-28-224	CKO6BX224K	56289
C6	CAP CER 1UF 50V 10%	034-28-105	CKO6BX105K	56289
C7	CAP TANT 1.0UF 35V 10%	031-112-105	T368A105KO35AS	05397
C8	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C9	CAP TANT 1.0UF 35V 10%	031-112-105	T368A105KO35AS	05397
C10	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C11	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C12	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C13	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C14	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C15	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C16	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C17	CAP CER 00 200V 10% SAT	034-27-000	CKO5BX000K	56289
C18	CAP CER 1UF 50V 10%	034-28-105	CKO6BX105K	56289
C19	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C20	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C21	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C22	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C23	CAP CER .1UF 50V 10%	034-27-104	CKO5BX104K	56289
C24	CAP TANT 47.0UF 35V 10%	031-112-476	T368D476KO35AS	05397
C25	CAP TANT 10.0UF 35V 10%	031-112-106	T368C106KO35AS	05397
C26	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C27	CAP TANT 10.0UF 35V 10%	031-112-106	T368C106KO35AS	05397
C28	CAP CER .01UF 100V 10%	034-27-103	CKO5BX103K	56289
C29	CAP MICA SOT 500V 5%	034-29-000	CD6CD000003	88124
CR1	DIODE ZENER SILICON 500MW 4.7V	012-324-4R7	1N5230	81349
CR2	DIODE ZENER SILICON 500MW 4.7V	012-324-4R7	1N5230	81349
CR3	DIODE ZENER	012-50	1N751A	81349
CR4	DIODE ZENER	012-50	1N751A	81349
CR5	DIODE ZENER	012-50	1N751A	81349
CR6	NOT USED			
CR7	NOT USED			
CR8	DIODE GENERAL PURPOSE	012-51	1N3064	81349
DS1	LED GREEN HP HLMP 1501	012-325-3	5082-4984	28480
J1	NOT USED			
J2	NOT USED			
J3	CONN STRAIGHT JACK SMB 50 OHM	063-143	51-051-0000	98291
J4	CONN STRAIGHT JACK SMB 50 OHM	063-143	51-051-0000	98291
J5	CONN HEADER RT ANGLE 4 PIN	062-208-4	87632-4	00779
K1	RELAY DIP DPDT	047-40	W172D1P-21	94696
L1	INDUCTOR 100UH 5%	041-30-101	WEE-100	91279
L2	INDUCTOR 100UH 5%	041-30-101	WEE-100	91279
Q1	TRANSISTOR	012-139	2N4401	81349
Q2	TRANSISTOR	012-140	2N4403	81349
Q3	TRANSISTOR	012-208	MJE2901	04713
Q4	TRANSISTOR	012-139	2N4401	81349
Q5	TRANSISTOR	012-139	2N4401	81349
Q6	TRANSISTOR	012-139	2N4401	81349
R1	RES CARBON COMP 2.2MEG 1/4W 5%	025-25-2R2M	RCO7GF225J	81349
R2	RES CARBON COMP 2.2MEG 1/4W 5%	025-25-2R2M	RCO7GF225J	81349
R3	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R4	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R5	RES METALFILM 681 1/4W 1%	025-33-6810	C4681R 1%	14674
R6	RES METALFILM 100K 1/4W 1%	025-33-1003	C4100K 1%	14674
R7	RES CARBON COMP 2.2MEG 1/4W 5%	025-25-2R2M	RCO7GF225J	81349
R8	RES METALFILM 47.5 1/4W 1%	025-33-47R5	C447.5R 1%	14674
R9	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
R10	RES METALFILM 15K 1/4W 1%	025-33-1502	C415K 1%	14674
R11	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R12	RES METALFILM 221 1/4W 1%	025-33-2210	C4221R 1%	14674

TABLE 6-4. RF AMPLIFIER P.C. BD. ASSEMBLY, A3, 138-449, REV. H

-CONTINUED-

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
R13	RES METALFILM 22.1K 1/4W 1%	025-33-2212	C422.1K 1%	14674
R14	RES METALFILM 1500 1/4W 1%	025-33-1501	C41.5K 1%	14674
R15	RES METALFILM 1500 1/4W 1%	025-33-1501	C41.5K 1%	14674
R16	RES WW 1 1W 1%	026-67-1	RS-1A-1-1	91637
R17	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
R18	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R19	RES METALFILM 41.2 1/4W 1%	025-33-41R2	C441.2R 1%	14674
R20	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R21	RES METALFILM 200K 1/4W 1%	025-33-2003	C4200K 1%	14674
R22	POT 100K 3/4W 10%	020-189-100K	3815-P-104	52500
R23	RES METALFILM 1M 1/2W 1%	025-34-1004	C51M 1%	14674
R24	RES METALFILM 15K 1/4W 1%	025-33-1502	C415K 1%	14674
R25	POT TRIMPOT 20K 3/4W	020-189-20K	3815-P-203	52500
R26	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R27	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R28	RES METALFILM 24.9K 1/4W 1%	025-33-2492	C424.9K 1%	14674
R29	RES METALFILM 51.1K 1/4W 1%	025-33-5112	C451.1K 1%	14674
R30	RES METALFILM 2.32K 1/4W 1%	025-33-2321	C42.32K 1%	81349
R31	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R32	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R33	RES METALFILM 1M 1/2W 1%	025-34-1004	C51M 1%	14674
R34	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R35	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R36	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R37	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R38	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R39	RES METALFILM 33.2K 1/4W 1%	025-33-3322	C433.2K 1%	14674
R40	RES METALFILM 100K 1/4W 1%	025-33-1003	C4100K 1%	14674
R41	RES METALFILM 33.2K 1/4W 1%	025-33-3322	C433.2K 1%	14674
R42	RES METALFILM 100K 1/4W 1%	025-33-1003	C4100K 1%	14674
R43	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R44	RES METALFILM 825 1/4W 1%	025-33-8250	C4825R 1%	14674
R45	POT TRIMPOT 20K 3/4W	020-189-20K	3815-P-203	52500
R46	RES METALFILM 1 MEG 1/4W 1%	025-33-1004	C41M 1%	14674
R47	RES METALFILM 1 MEG 1/4W 1%	025-33-1004	C41M 1%	14674
SJ1	CONN JACK SHORTING	062-207	450-3775-01-06-10	71279
TP1	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP2	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP3	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP4	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP5	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP6	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP7	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP8	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP9	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP10	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP11	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
U1	IC CAZ OP AMP	015-07-76001	ICL76001JD	32293
U2	IC TRANSISTOR ARRAY	015-09-3096E	CA3096E	96684
U3	IC AMPLIFIER INSTRUMENTATION	015-07-101	INA101C™	13919
U4	OP AMP	012-283	LF356H	12040
U5	IC OP AMP DUAL JFET INPUT	015-07-353	LFL353N	12040
U6	IC OP AMP	015-07-07	OP07EJ	06665
U7	OP AMP	012-283	LF356H	12040
U8	IC CURRENT AMPLIFIER	015-07-0002	LH0002CN	12040
1	HEATSINK	074-689	6073B	13103

TABLE 6-5. MOTHERBOARD POWER SUPPLY ASSEMBLY, A6, 138-404, REV. K

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
C1	CAP CER .33MF 50V 20%	034-25-334	CY20C334M242	60464
C2	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C3	CAP ELEC 4700UF 35V	031-95	CAE 4700UF 35V	62462
C4	CAP ELEC 4700UF 35V	031-95	CAE 4700UF 35V	62462
C5	CAP TANT 2.2UF 25V 20%	031-90	T362B225M025AS	05397
C6	CAP TANT 10UF 35V 20%	031-80	T362C106M035AS	05397
C7	CAP CER 1MF 50V 20%	034-25-105	CY30C105M242	60464
C8	CAP ELEC 2300UF 50V -10% +75%	032-57	39D238G050JT4	56289
C9	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C10	CAP TANT 10UF 35V 20%	031-80	T362C106M035AS	05397
C11	CAP TANT 1UF 35V 20%	031-78	T368A105M035AS	05397
C12	CAP ELEC 4000UF 15V	031-83	39D408G015JL4	56289
C13	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C14	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
C15	CAP CER .1UF 50V 20%	034-25-104	CY20C104M242	60464
CR1	BRIDGE RECTIFIER	012-271	VH247	83003
CR2	BRIDGE RECTIFIER	012-271	VH247	83003
CR3	DIODE RECTIFIER 100V 1A	012-293	1N4002	14433
CR4	DIODE RECTIFIER 100V 1A	012-293	1N4002	14433
CR5	BRIDGE RECTIFIER	012-271	VH247	83003
CR6	DIODE ZENER 6.8V 5W 5%	012-356	UZ5706	12969
CR7	DIODE ZENER	012-50	1N751A	81349
P1	CONN HEADER 40 PIN	062-204-40	87478-7	00779
Q1	TRANSISTOR	012-206	MPSU05	04713
Q2	TRANSISTOR	012-140	2N4403	81349
Q3	TRANSISTOR	012-186	MJE6044	04713
Q4	TRANSISTOR PNP	012-194	MPSU55	04713
R1	RES CARBON COMP 2700 1/2W 5%	025-8-2700	RC20GF272J	81349
R2	RES METALFILM 1500 1/4W 1%	025-33-1501	C41.50K 1%	14674
R3	RES METALFILM 1500 1/4W 1%	025-33-1501	C41.50K 1%	14674
R4	RES METALFILM 3480 1/4W 1%	025-33-3481	C43.48K 1%	14674
R5	RES METALFILM 237 1/4W 1%	025-33-2370	C4237R 1%	14674
R6	RES CARBON COMP 100 1/2W 5%	025-8-100	RC20GF101J	81349
R7	RES CARBON COMP 10000 1/2W 5%	025-8-10K	RC20GF103J	81349
R8	RES CARBON COMP 560 1/2W 5%	025-8-560	RC20GF561J	81349
R9	RES CARBON COMP 270 1/4W 5%	025-25-270	RC07GF271J	81349
R10	RES CARBON COMP 2500 1/4W 5%	025-25-2500	RC07GF252J	81349
R11	RES CARBON COMP 270 1/4W 5%	025-25-270	RC07GF271J	81349
R12	RES CARBON COMP 270 1/4W 5%	025-25-270	RC07GF271J	81349
R13	RES CARBON COMP 270 1/4W 5%	025-25-270	RC07GF271J	81349
T1	POWER TRANSFORMER	040-190	9118	93459
TP1	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP2	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP3	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP4	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP5	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP6	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
TP7	CONN PIN RECEPTACLE PC	062-153	460-2970-02-03-00	71279
U1	IC REGULATOR +15V	015-07-78M15	UA78M15UC	82170
U2	IC OP AMP HIGH VOLTAGE	015-07-343H	LM343H	12040
U3	IC REGULATOR -15V	015-07-79M15	UA79M15UC	82170
U4	IC VOLTAGE REGULATOR	015-07-LM317K	LM317K	12040
U5	IC REGULATOR +5 VOLTS	015-07-7805K	SG7805CK	34333
U6	IC HEX INVERTER/BUFFER	015-01-4049	MC14049BCP	04713
XA1	CONN CARD EDGE 80 PIN SOLDER	062-210-403	3-531340-4	00779
XA2	CONN CARD EDGE 80 PIN SOLDER	062-210-403	3-531340-4	00779
XA3	CONN CARD EDGE 80 PIN SOLDER	062-210-403	3-531340-4	00779
XA4	CONN CARD EDGE 80 PIN SOLDER	062-210-403	3-531340-4	00779
XA5	CONN CARD EDGE 80 PIN SOLDER	062-210-403	3-531340-4	00779

Table 6-6. +30 V POWER SUPPLY ASSEMBLY, A7, 138-419, REV. H

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
C1	CAP, ELEC, 2300 UF, 50 V, -10%, +75%	032-57	39D238G050JT4	56289
C2	CAP, CER, .1 UF, 50 V, 20%	034-25-104	CY20C104M242	60464
C3	NOT USED			
C4	CAP, TANT, 1 UF, 35 V, 20%	031-78	T368A105M035AS	05397
CR1	BRIDGE RECTIFIER	012-271	VH247	83003
CR2	DIODE RECTIFIER, 100 V, 1 A	012-293	1N4002	14433
CR3	NOT USED			
CR4	DIODE, ZENER, PRECISION, 6.9 V	012-391	LM129AH	12040
R1	RESISTOR, FILM, S.A.T.	025-33-0000		93459
R2	RESISTOR, POT, 200 K, 10%, 1/2 W	020-195-204		93459
R3	RESISTOR, FILM, 5.11 K, 1%, 1/8 W	025-28-5110		93459
R4	RESISTOR, FILM, 1.33 K, 1%, 1/4 W	025-33-1331		93459
R5	RESISTOR, FILM, 2.43 K, 1%, 1/8 W	025-28-2430		93459
R6	RESISTOR, WW, 120 OHM, 3%, 2 W	026-42-120		93459
U1	I.C., VOLTAGE REGULATOR	015-07LM317K	LM317K	12040

TABLE 6-7. FRONT PANEL ASSEMBLY, A8, 138-394-1, REV. B

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
DS1	LED GREEN WITH BLACK HOLDER	012-288	5082-4955	28480
DS2	LED GREEN WITH BLACK HOLDER	012-288	5082-4955	28480
DS3	LED RED	012-393	5082-4655	28480
DS4	LED GREEN WITH BLACK HOLDER	012-288	5082-4955	28480
DS5	LED AMBER	012-392	5082-4555	28480
DS6	LED RED	012-393	5082-4655	28480
DS7	LED RED	012-393	5082-4655	28480
E1	CONN BINDING POST BLACK	062-19-1	257-103	83330
E2	CONN BINDING POST RED	062-19-2	257-102	83330
J1	CONN 4 CONTACTS W/062-117	062-131	91-PC-4M	52500
J2	CONN 40 PIN	062-173	86896-2	00779
M1	METER 1805	016-55	1921	10625
M2	METER WESTON 111 W/GREEN FIELD	016-153	111-1621010	10625
P1	CONN HOUSING 2 PIN	062-216-2	87159-3	00779
P5	CONN HOUSING 4 PIN	062-216-4	87159-5	00779
R1	POT WW 10 TURN 20K 3%	020-182	534-203	16556
R2	POT WW 10 TURN 200 OHM	020-181	534-200	16556
R3	RES METALFILM 00 1/4W 1% SOT	025-33-0000	RN55D	81349
S1	SWITCH DPDT	055-81	571-2721-0601-054	96312
S2	SWITCH SPDT	055-51	7101-PYZBE	09353
S3	ASSY ROTARY SWITCH ADAPTER	138-465		93459
W1	WIRE, BUS #22 SOLID TIN COPPER	079-26-3	298	90895
W2	CABLE FLAT 40 CONDUCTOR	079-108-40	86-45-28-4000	92607
W3	WIRE #22 BROWN TEFLON	079-147-1		93459
W4	WIRE #22 RED TEFLON	079-147-2		93459
W5	WIRE #22 ORANGE TEFLON	079-147-3		93459
W6	WIRE #22 YELLOW TEFLON	079-147-4		93459
W7	WIRE #22 BLACK TEFLON	079-147-10		93459
W8	WIRE #22 GREEN TEFLON	079-147-5		93459

TABLE 6-8. REAR PANEL ASSEMBLY, A9, 138-467-1, REV. B

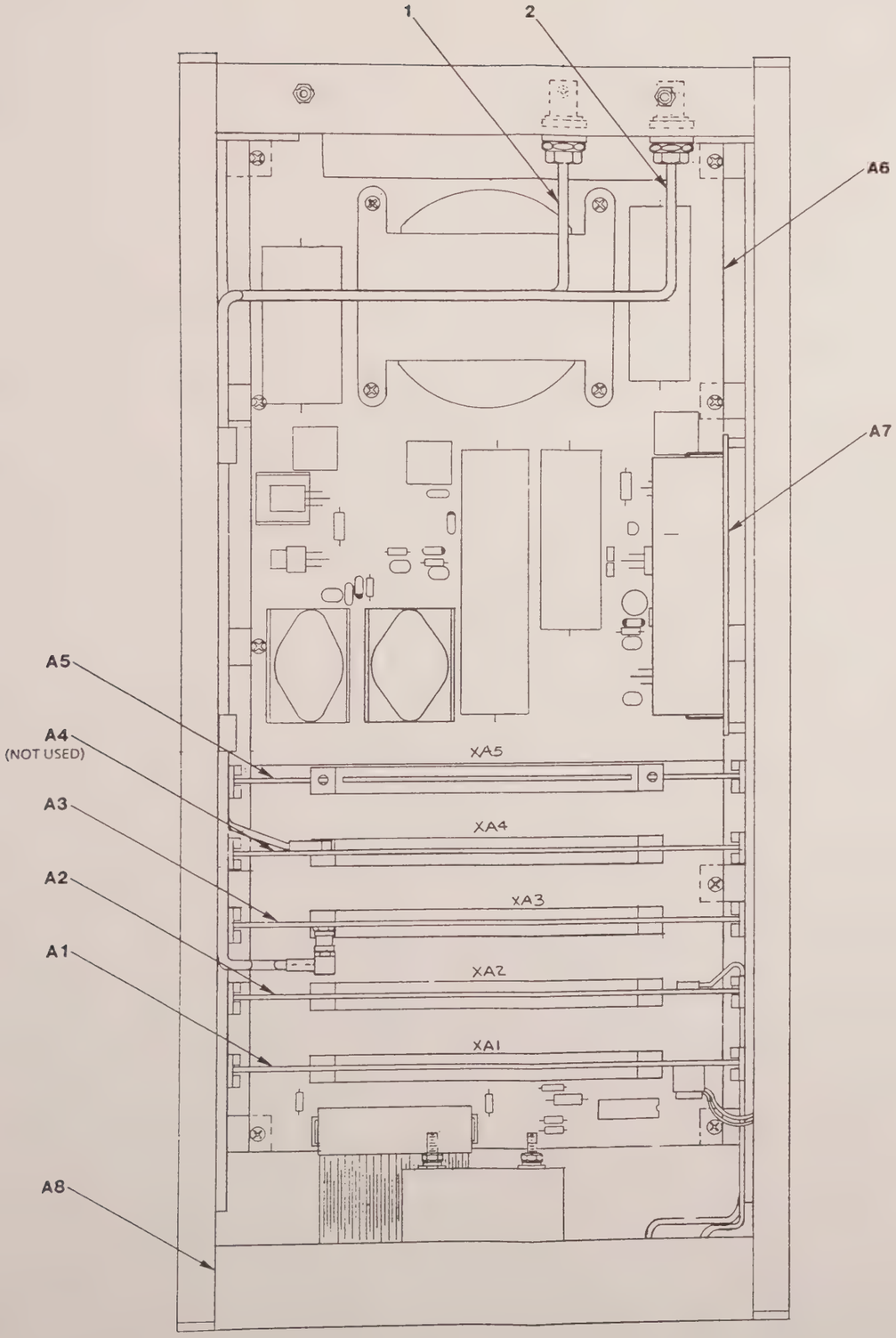
REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
F1	FUSE 1/2 AMP SLO-BLO	052-1-1/2SB	313.500	71400
J1	NOT USED			
J2	ASSY CABLE	138-476-3		93459
J3	ASSY CABLE IEEE BUS	138-414		93459
J4	CONN FEMALE MINI 9 PIN	062-76	126-221	52500
J5	CONN FEMALE MINI 9 PIN	062-76	126-221	52500
J6	ASSY CABLE	138-476-2		93459
S1	ASSY PC BD IEEE ADDRESS SWITCH	138-462		93459
W1	NOT USED			
W2	WIRE #22 RED TEFLON	079-147-2		93459
W3	WIRE #22 ORANGE TEFLON	079-147-3		93459
W4	WIRE #22 YELLOW TEFLON	079-147-4		93459
W5	WIRE #22 GREEN TEFLON	079-147-5		93459
W6	WIRE, BUS #26 SOLID TIN COPPER	079-26-6	8023-100	16428
W7	WIRE #26 BLACK	079-146-10		93459
W8	NOT USED			
W9	WIRE #22 BROWN TEFLON	079-147-1		93459
W10	WIRE #22 BLACK TEFLON	079-147-10		93459
W11	WIRE #22 RED TEFLON	079-147-2		93459
W12	WIRE #22 BLACK TEFLON	079-147-10		93459
W13	WIRE #22 WHITE TEFLON	079-147-9		93459
W14	WIRE #22 BLACK TEFLON	079-147-10		93459
W15	WIRE #22 WHITE TEFLON	079-147-9		93459
W16	WIRE #22 WHITE TEFLON	079-147-9		93459
W17	WIRE #22 BLACK TEFLON	079-147-10		93459
W18	NOT USED			
W19	WIRE, BUS #26 SOLID TIN COPPER	079-26-6	8023-100	16428
W20	WIRE #22 BLACK TEFLON	079-147-10		93459
XF1	FUSE HOLDER AND POWER INPUT	051-28	6J4	05245
1	PANEL REAR	138-389-1		93459

SECTION 7
DRAWINGS AND CIRCUIT DESCRIPTIONS

7.1 INTRODUCTION

The Model 1805B contains four key circuits which are schematically depicted overall in Figure 7-3 and in the simplified schematic shown in Figure 7-1. These four circuits are the motherboard power supply, the microprocessor board, the dc substitution board, and the RF power board. The +5-Volt regulator allows the user to operate in the standby state. In the standby state, the temperature control circuit remains active to allow temperature stabilization of the Model 1109 thermistor mount. The following section contains descriptions of the various circuits, component location drawings for each assembly, and associated schematics.

Refer to Section 4 of this manual for a discussion of the principles of operation of the Model 1805B, including overall descriptions of the principle of dc substitution and the RF power level control system.



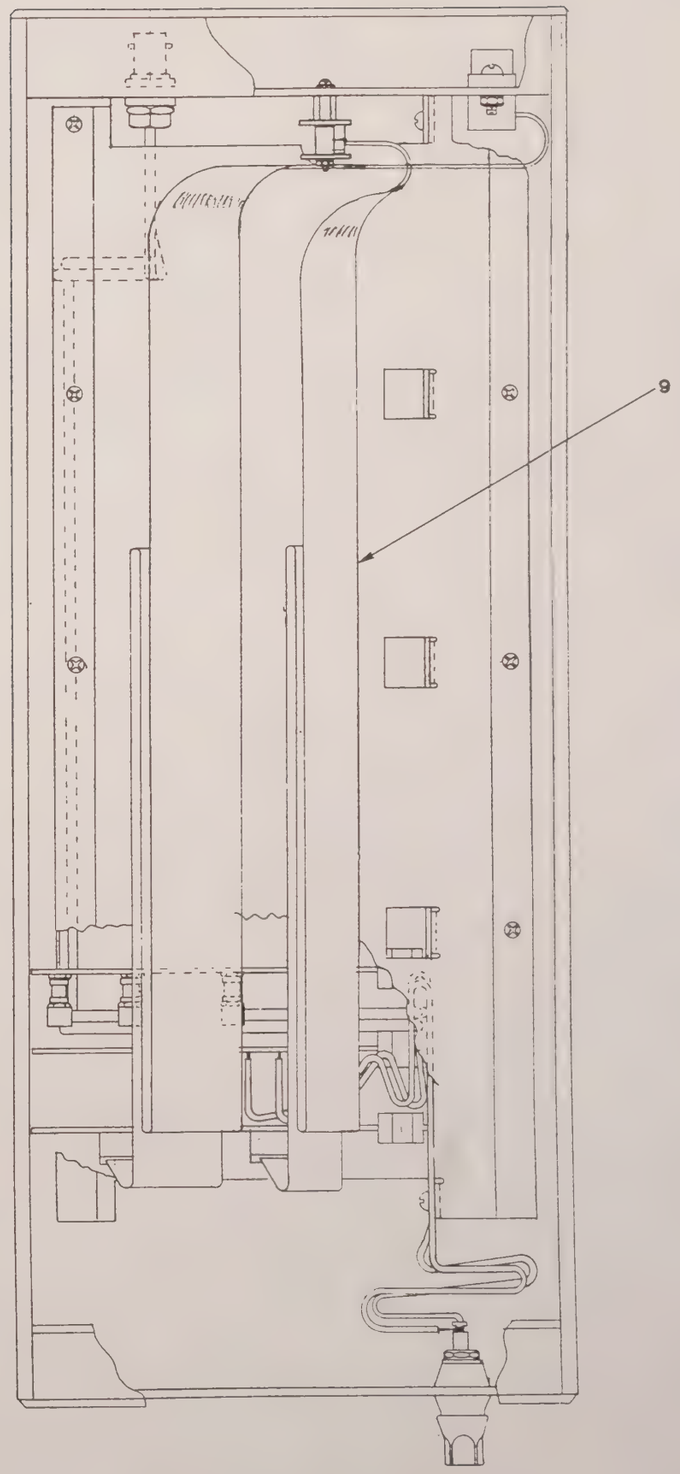


Figure 7-1
Model 1805B Overall Assembly
138-415-1, Rev. E

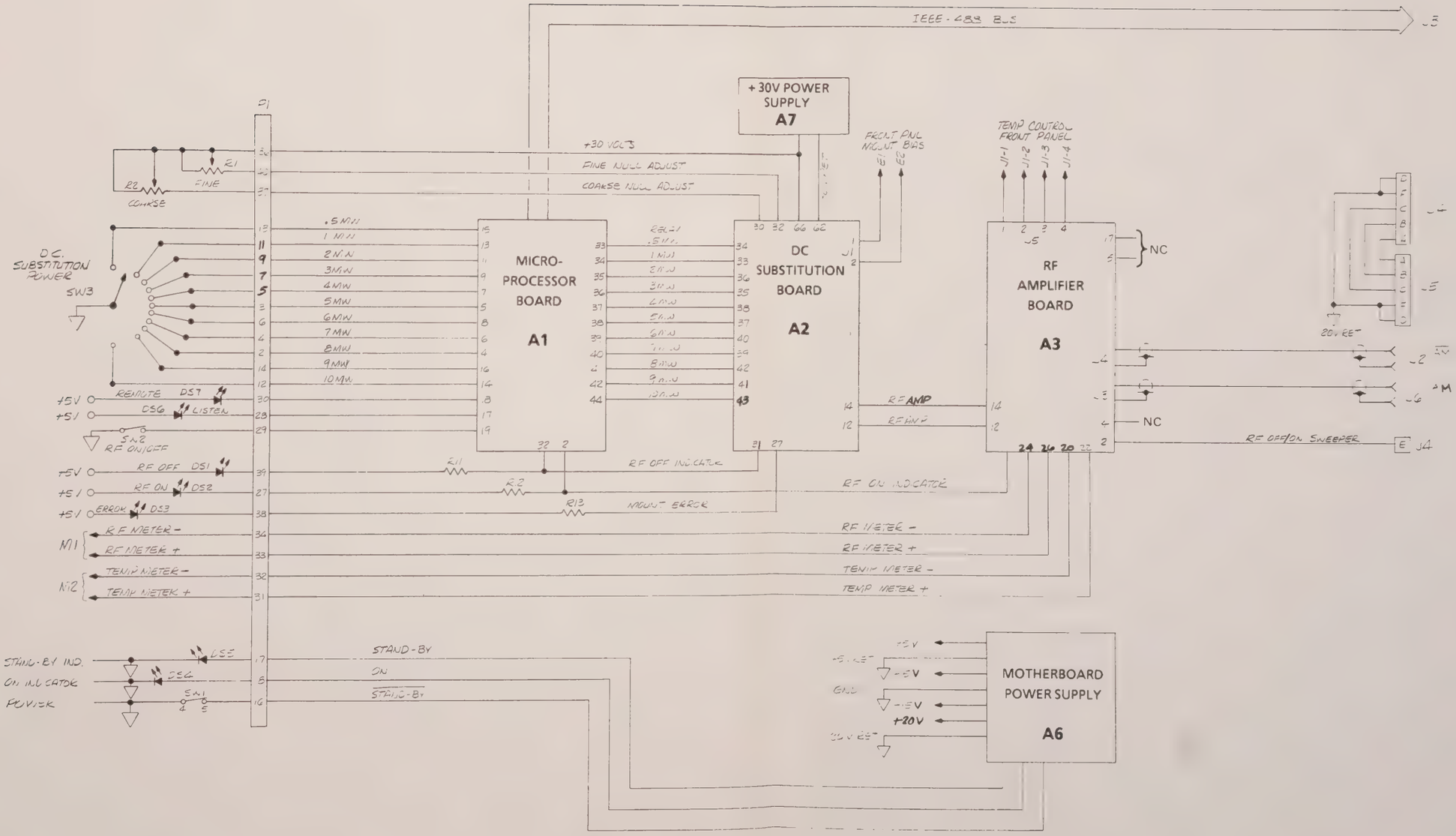


Figure 7-2
Model 1805B Overall Schematic
138-529, Rev. C

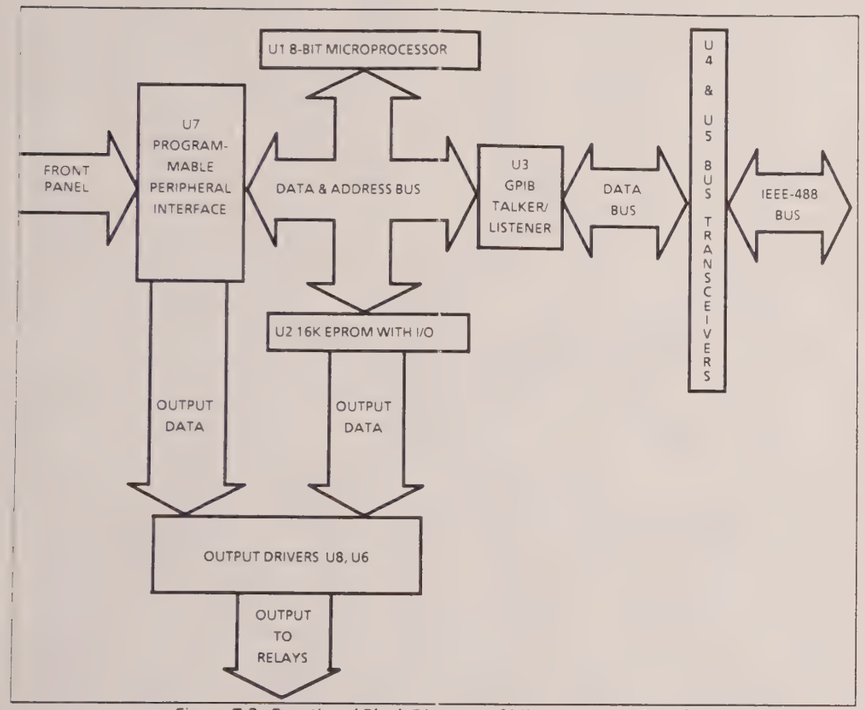


Figure 7-3. Functional Block Diagram of Microprocessor Board

MICROPROCESSOR BOARD

The microprocessor board, functionally depicted in Figure 7-3 and schematically represented in Figure 7-5, reads control information from either the front panel (local control) or the rear panel IEEE-488 bus interface (remote control). The board decodes this control information and performs the tasks needed to implement the control function. The 1805B's functions include switching of dc substitution levels to eleven possible settings and the control of the RF ON/OFF switching.

The heart of the microprocessor board is U1, an INTEL eight-bit 8085 parallel microprocessor with a 6-MHz clock. U1 interprets instructions stored in EPROM (erasable electrically-programmable ROM) U2, which also serves as an I/O chip. These instructions guide the microprocessor in its operation through two main modes: local and remote operation. In local mode the user programs the instrument by switching front panel controls that switch status receivers that are part of I/O chip U7. The program instructions stored in EPROM U2 continuously update these status receivers, which are scanned by the microprocessor to derive local mode instructions. If the front panel status changes, the microprocessor outputs the proper bits to the board drivers through the output latches of U7 or U2. The board drivers (U8 and U6) energize the relays associated with the 1805B circuits responsible for this function. Due to the continual scanning of the microprocessor, detection of any front panel function change occurs unless the 1805B is set to remote mode in which case the microprocessor switches to a new set of instructions.

In remote mode the microprocessor, U1, follows remote operation instructions stored in EPROM U2. These instructions tell the processor to scan U3, the IEEE talker/listener chip status register for function changes. U3 is a microprocessor-controlled chip with eight read and eight write registers that interfaces the Model 1805B to an IEEE-488 interface bus via two non-inverting bus transceivers, U4 and U5. When interpreting a function change, remote mode operation of the processor is identical to local mode operation, i.e., the processor outputs the correct bits to the driver chips to implement the required function.

Since the microprocessor is scanning U3, the front panel is de-activated. Therefore, switching front panel controls does not cause a functional change by the unit. Once in the remote mode U3 handles all bus protocol. If the external controller requires status information, U3 asks the microprocessor for the instrument's status. The processor informs U3 of its current status which U3 outputs to the external controller. An addressing scheme allows multiple instrument control on the same IEEE-488 bus. Each instrument has its own unique address. U3 decodes the IEEE addresses sent by the common bus until it sees its unique address, which tells it the information to follow is for that unit. U3 fetches its unique address from the I/O portion of the dual-purpose EPROM- I/O chip, U2.

Figure 7-4
Microprocessor P.C. Bd. Assy., A1
Component Location
138-398, Rev. D

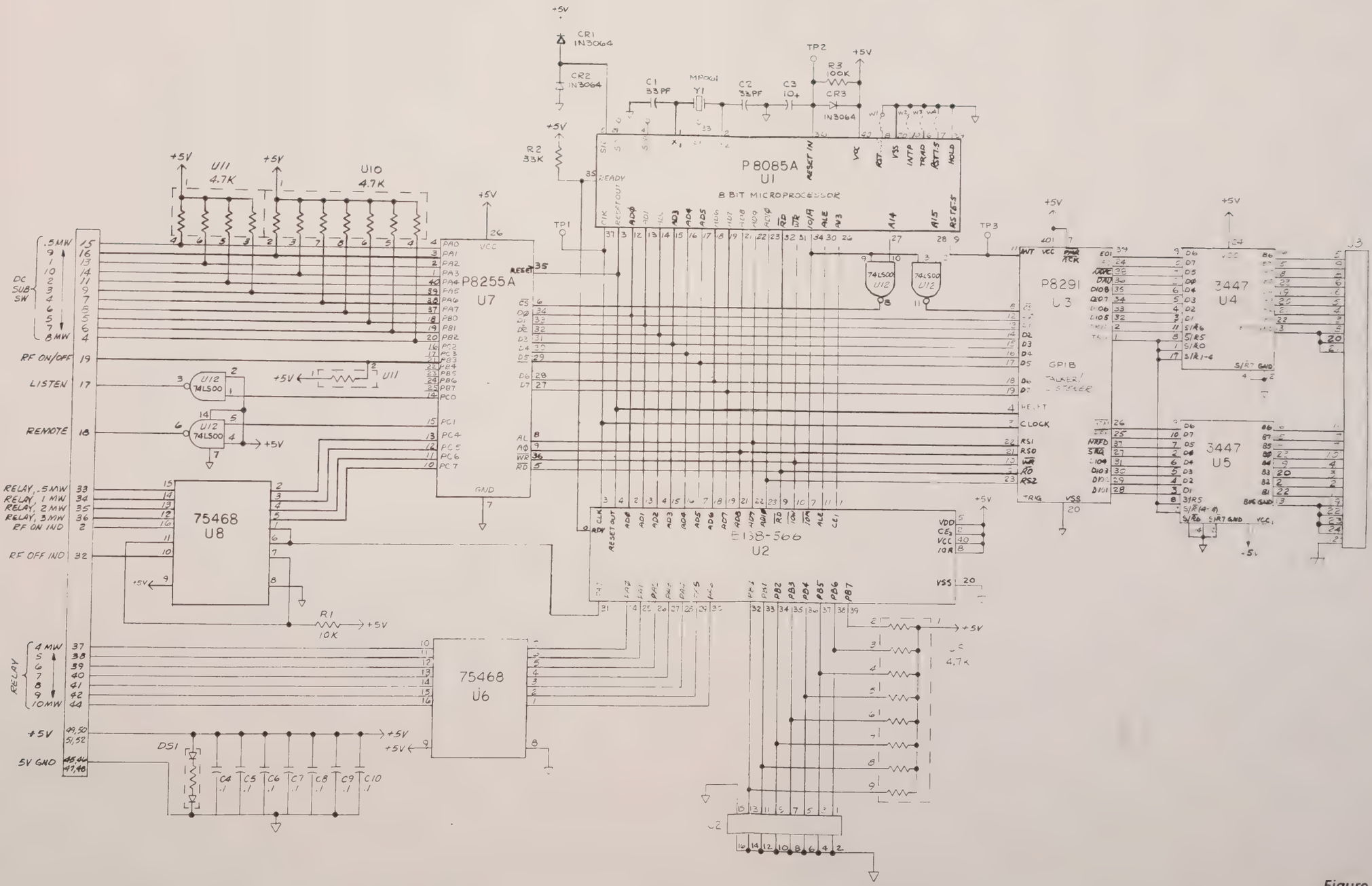


Figure 7-5
Microprocessor P.C. Bd. Assy., A1
Schematic Diagram
138-393, Rev. C

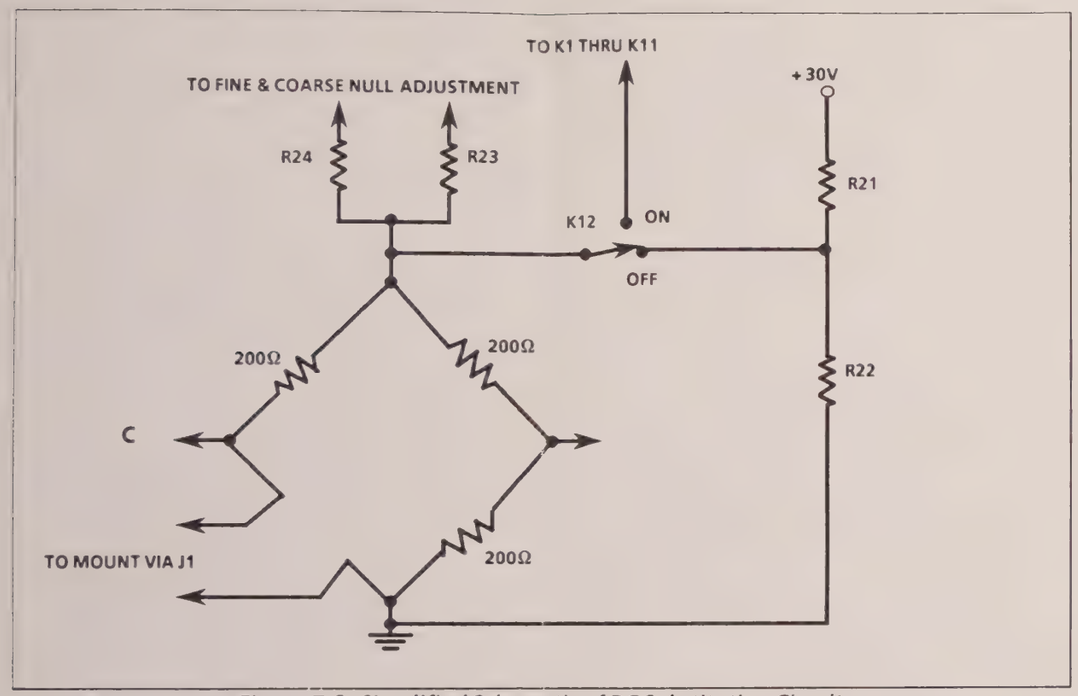


Figure 7-6. Simplified Schematic of DC Substitution Circuit

DC SUBSTITUTION BOARD

The dc substitution board, schematically depicted in Figure 7-8, contains precision dc circuits which give the 1805B its primary accuracy. These circuits have two functions: dc substitution and error detection.

DC Substitution Circuit

Figure 7-6 depicts a simplified schematic of the dc substitution circuit. It is comprised of three legs of a resistive Wheatstone bridge, whose fourth leg is contained in a feedthrough thermistor mount. This fourth leg containing thermistor beads links to the 1805B via board connector J1. Relay K12 allows this circuit board to achieve two fundamental working states. If Relay K12 is not energized, the RF OFF functions take place; if K12 is energized, the RF ON functions take place. Switching of precisely-set resistive sections across the Wheatstone bridge according to the desired dc substitution level causes a change in the bridge currents. This change in current is called the dc substitution for the reasons explained in Paragraph 4.2.

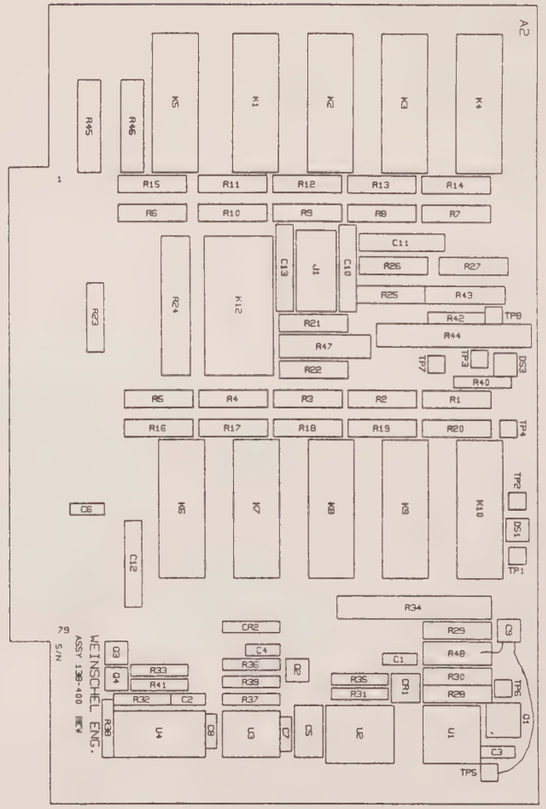
Without application of RF power (RF OFF) to the system thermistor mount, the dc substitution board provides the current through the bridge sufficient to bias this thermistor mount at 30 mW. The 200-ohm equivalent resistance of the Weinschel Engineering Model 1109 Feedthrough Mount, which makes up one leg of the Wheatstone bridge, dictates the 1805B's 30-mW operating point. Relay K12 in this state allows the resistive section consisting of R21 and R22 to shunt the bridge circuit. This causes the correct current to flow for 30-mW bias. Fine and coarse adjustments to the bridge current by front panel potentiometers correct small errors in the thermistor bias operating point.

With the RF power applied to the system thermistor (RF ON), the mount requires less bias current to hold its operating point of 30 mW. In fact, by decreasing the dc bias by a known amount, RF can be applied until the original operating point is again achieved. The amount of RF power needed to find this operating point is proportional to the dc current removed. The dc substitution board gets its name from this substitution of dc power for RF power. Resistive sections bias the bridge for eleven different calibrated bias currents which correspond to eleven separate power substitutions. Switching of one of eleven relays (K1-K11) selects the corresponding resistive sections and shunts the section across the bridge via relay K12.

Error Detection Circuit

The dc substitution board also contains the bridge error circuit which senses an error condition directly across the thermistor.

The error detection circuit is only active during the RF OFF state This circuit senses that the 30-mW operating bias point is within .7 mW by comparing the sensed potential found across the thermistor to two reference voltages. These reference voltages are equivalent to those required to produce 29.3 mW and 30.7 mW across the thermistor . If the thermistor fails to bias within ±.7 mW of the 30-mW bias point, the front panel indicator illuminates.



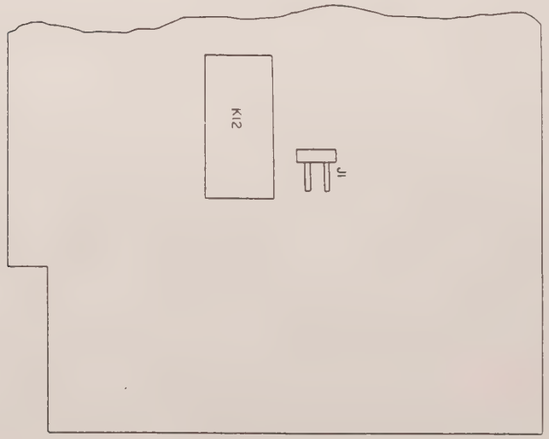
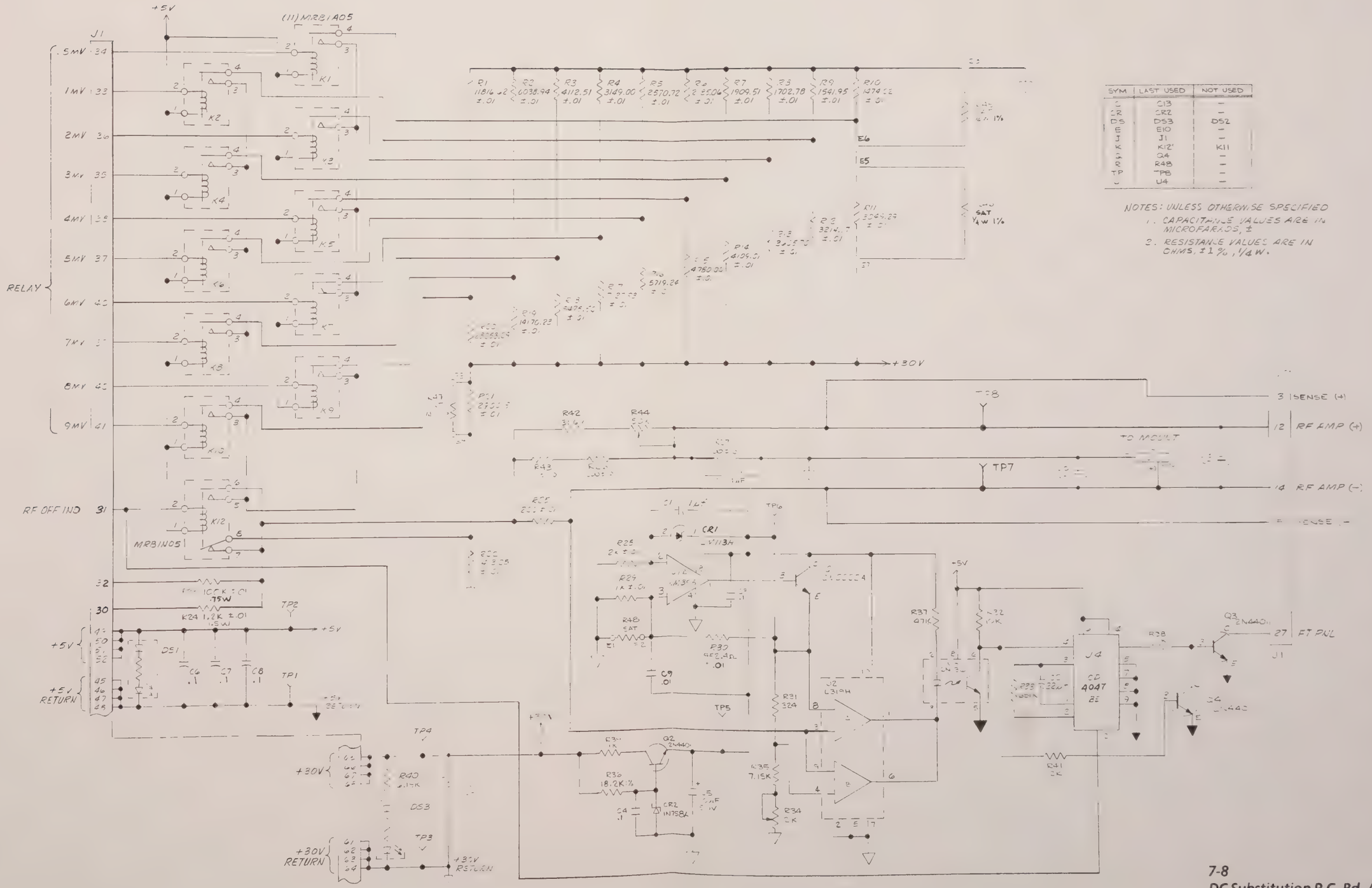


Figure 7-7
DC Substitution P.C. Bd. Assy., A2
Component Location
138-400, Rev. F



SYM	LAST USED	NOT USED
C	C13	—
CR	CR2	—
DS	DS3	DS2
E	E10	—
J	J1	—
K	K12	K11
Q	Q4	—
R	R48	—
TP	TP8	—
U	U4	—

NOTES: UNLESS OTHERWISE SPECIFIED

1. CAPACITANCE VALUES ARE IN MICROFARADS, ±
2. RESISTANCE VALUES ARE IN OHMS, ±1%, 1/4 W.

7-8
DC Substitution P.C. Bd. Assy., A2
Schematic Diagram
138-392, Rev. F

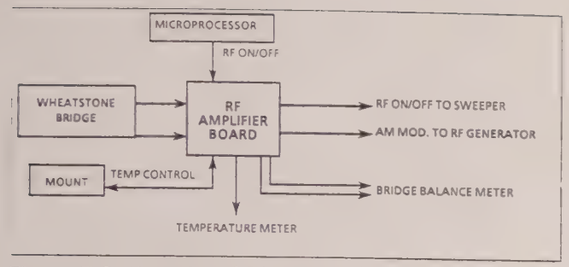


Figure 7-9. Functional Diagram of RF Amplifier Board

RF AMPLIFIER BOARD

The RF Amplifier board, functionally depicted in Figure 7-9 and schematically represented in Figure 7-12, contains two circuits that are instrumental in closed loop leveling in the RF ON mode. These circuits are a thermistor temperature controller and a bridge-sensed high-gain differential amplifier. RF Amplifier board circuitry also provides RF switching according to RF ON/OFF signals from the microprocessor board and bridge offset sensing that drives the front panel bridge balance meter.

Thermistor Mount Proportional Temperature Controller

The thermistor mount temperature controller senses imbalance of a thermal bridge and drives the mount heater in proportion to the imbalance signal to compensate for temperature variations. This board also controls two indicators. The first of these two indicators is temperature meter M2, which is located in the center of the front panel (see Figure 3-2). The green band on this meter indicates the proper operating temperature range. The second is a light-emitting diode DS1, located internally on the RF Amplifier board, that indicates a near steady-state temperature condition. Figure 7-10 presents a simplified schematic of the thermistor mount temperature controller circuitry.

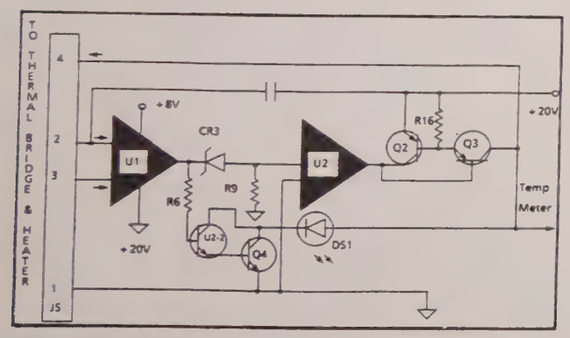


Figure 7-10. Simplified Schematic of Model 1805B Proportional Temperature Control Circuit

U1, a high-gain amplifier with excellent offset drift characteristics, senses the imbalance of a thermal bridge located in the temperature-stabilized feedthrough thermistor mount via pins 2 and 3 of board connector J5. This thermal bridge, which is composed of two types of resistance with differing temperature coefficients, balances at approximately 60°C. U1/U2 interaction provides a varying response to thermal bridge imbalance signal according to the relationship between the voltage differential inputs. U1/U2 amplifies an imbalance signal from a cold thermal bridge that forces the series pass transistor Q3 to pass a current proportional to the imbalance signal. This current acts to drive the mount heater to restore thermal bridge balance. As the thermal bridge nears the steady-state condition, Q3 causes DS1 to illuminate. If the mount is cold, DS1 does not illuminate since the Darlington pair configuration made up by U2-2 and Q4 is not in a conducting state. U1/U2 responds to an imbalance signal from an overheated mount by turning off Q3 so that it does not pass current to drive the heater or DS1.

Transistor Q2 and resistor R16 combine to provide circuit protection by limiting current in the event of an output short circuit. .

Bridge Offset Sensing Circuit

The bridge offset sensing circuit drives the 1805B front panel bridge balance meter by providing a total circuit gain sufficient to realize a 2 µW per division sensitivity in the front panel meter reading. To achieve this, instrumentation amplifier U3 senses the bridge differential and sources the amplified difference to a transconductance amplifier made up of amplifier U4, U5B and associated components. The transconductance amplifier sources the meter with a current proportional to the amplified difference seen from amplifier U3.

Bridge-sensed, High-gain Differential Amplifier

The bridge-sensed, high-gain differential amplifier senses the Wheatstone bridge imbalance. This circuit gives the 1805B the required gain to achieve the high sensitivity to the level of dc bias substituted for RF levels. Three operational amplifiers make up this amplifier. U6 senses the bridge differential and applies the high gain, U7 conditions signals, and U8 acts to drive the RF generator AM Modulation signal (via board connector J4 and rear panel connector J2). Relay K1 forces the output signal to the maximum attenuation level assuring that the RF power always starts from a low power state when the RF power is first switched on. This prevents the thermistor mount from seeing high power transients at switch points.

RF Switching Circuitry

The board also derives the switching signals required by most RF switches. The microprocessor board generates an RF ON/OFF signal that enables or disables Relay K1. This relay in turn opens or closes a 5-Volt loop that drives a switch in the RF generator (W/E Model 4310A/KN).

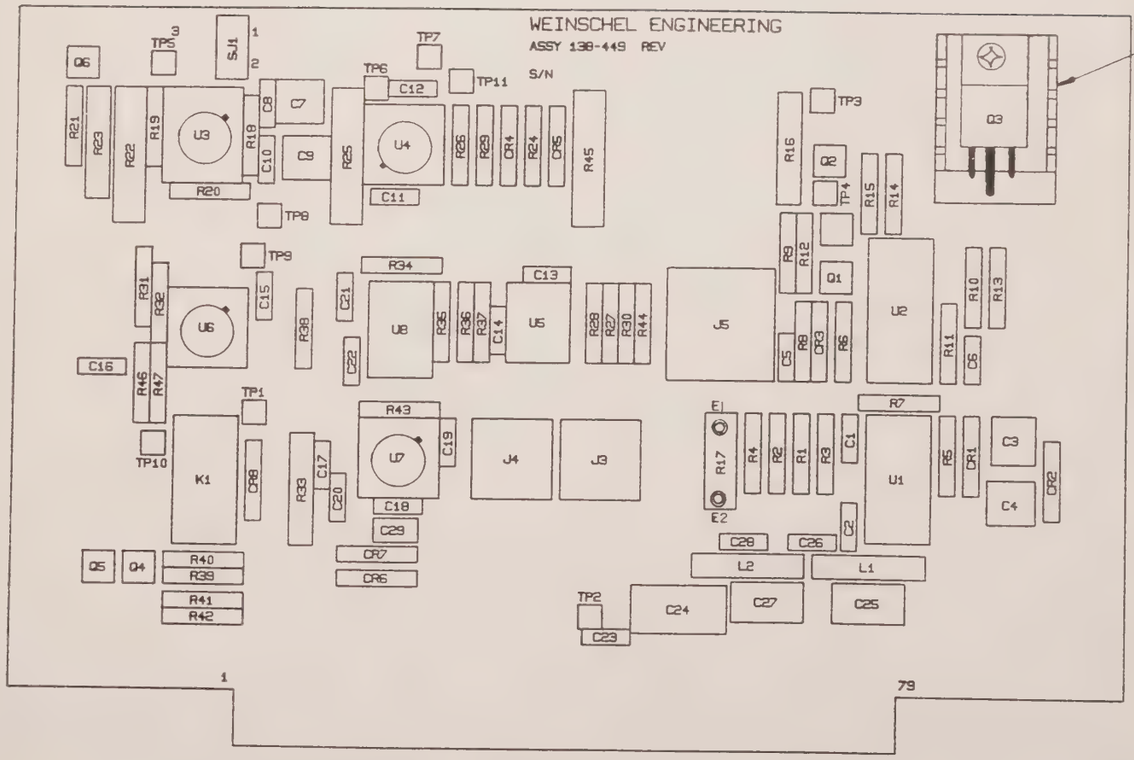


Figure 7-11
RF Amplifier P.C. Bd. Assy., A3
Component Location
138-449, Rev. J

SYM	LAST USED	NOT USED
C	C29	—
CR	CR8	—
DS	DS1	—
K	K1	—
L	L2	—
Q	Q6	—
R	R47	—
T	TP11	—
U	U8	—

Figure 7-12
RF Amplifier P.C. Bd. Assy., A3
Schematic Diagram
138-450, Rev. J

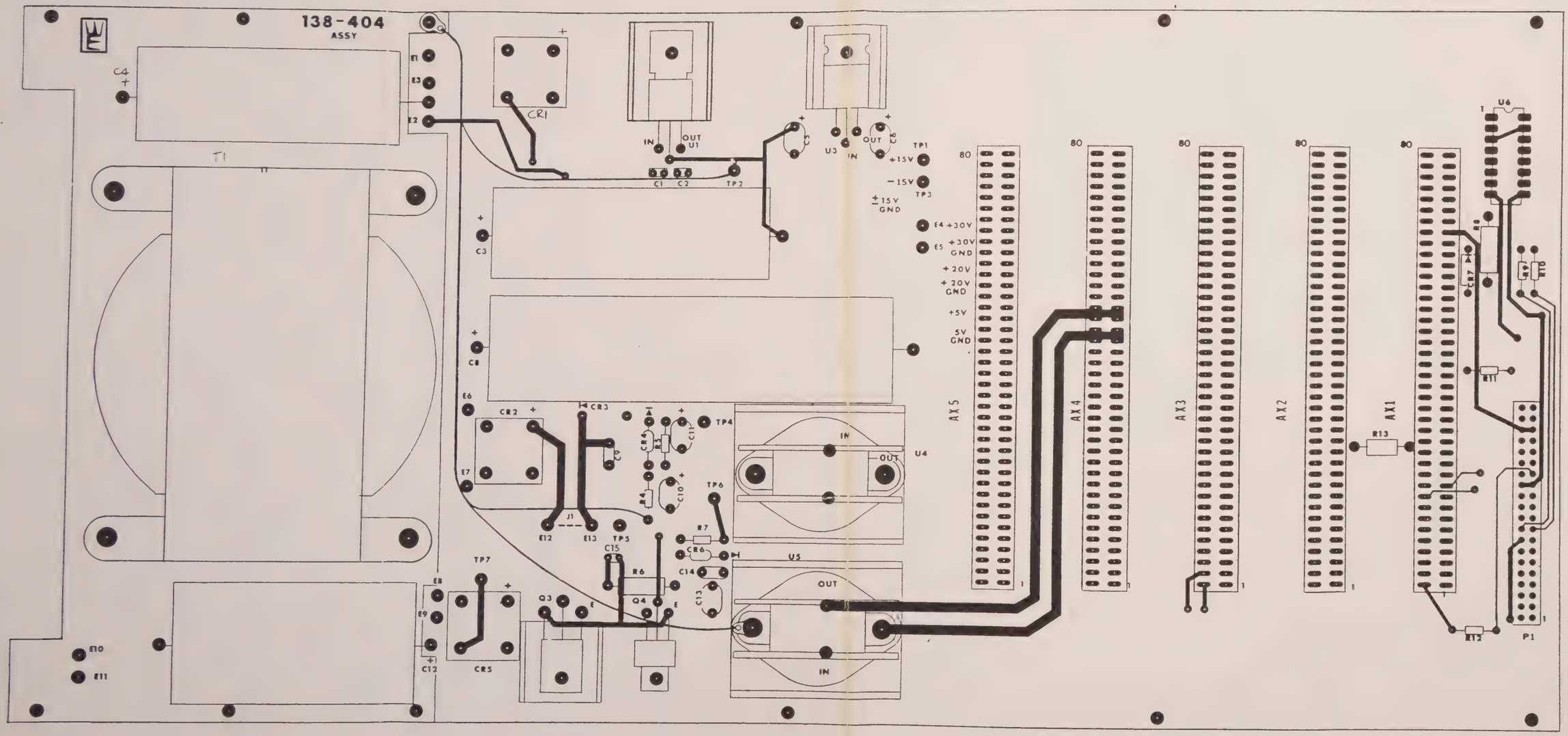


Figure 7-13
Power Supply and Motherboard Assy., A6, Component Location 138-404, Rev. F

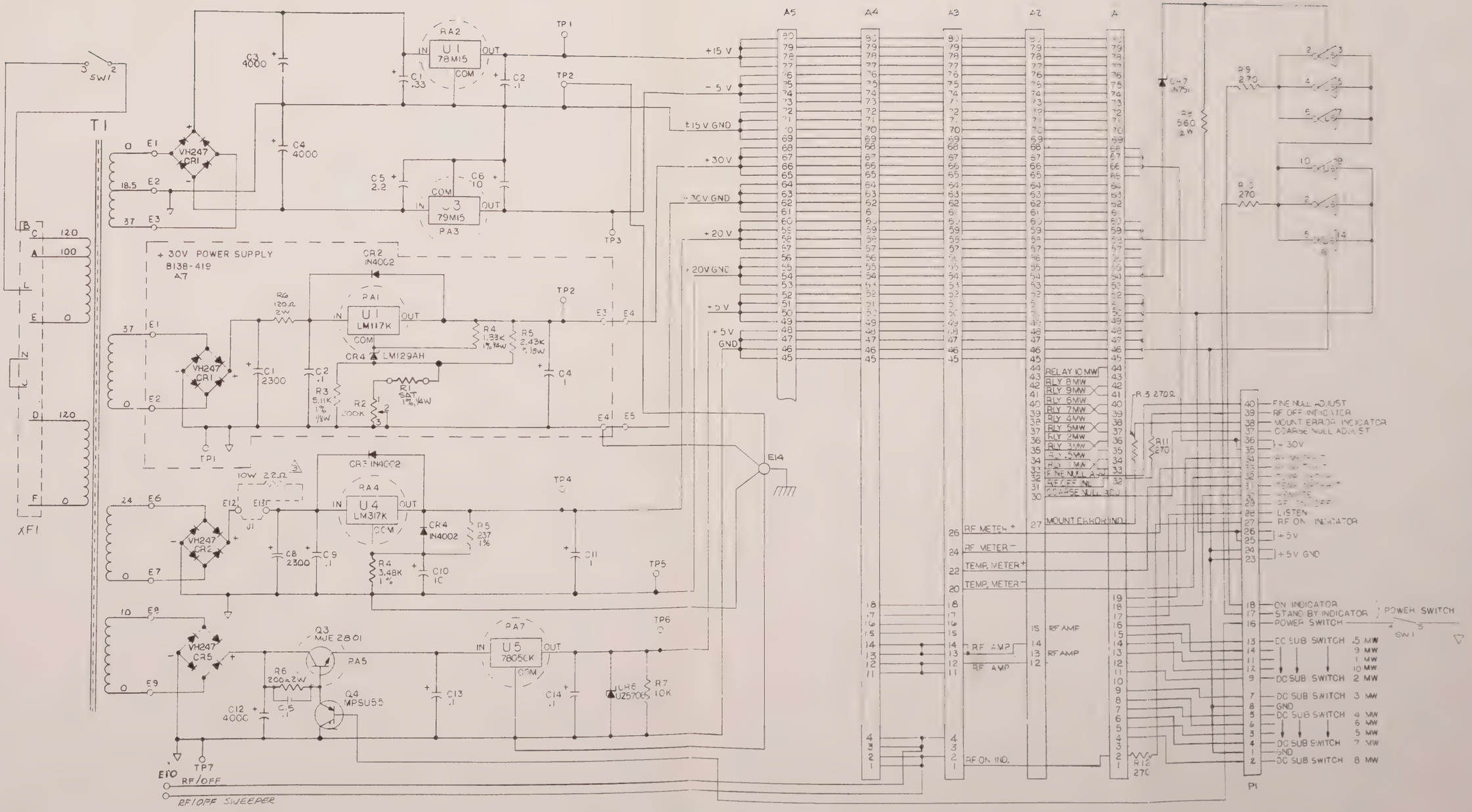


Figure 7-14
Power Supply and Motherboard Assy., A6, Schematic Diagram 138-391, Rev. G

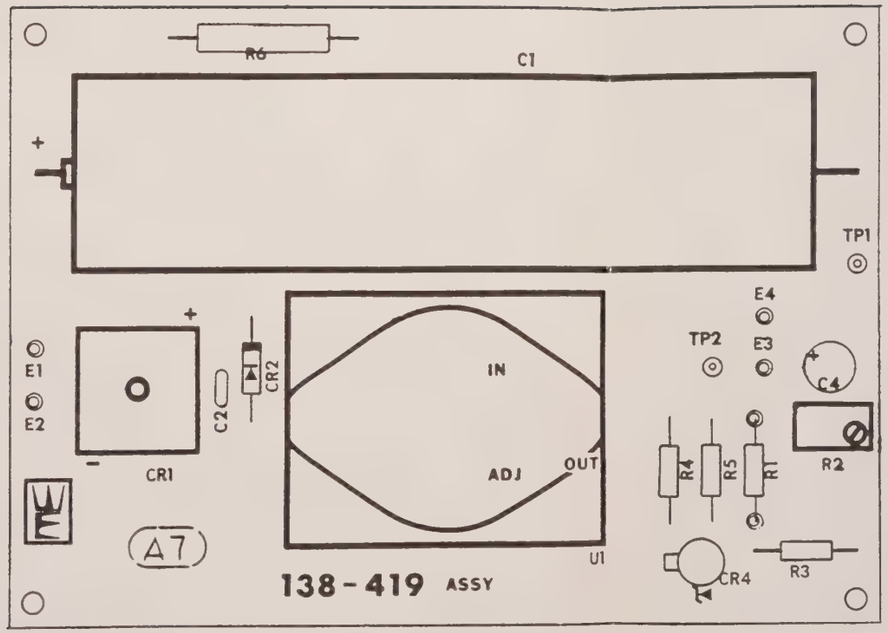
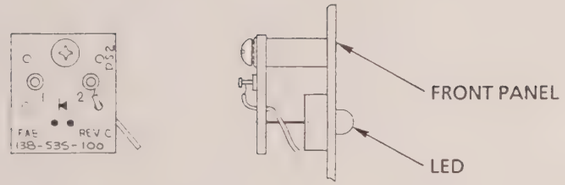
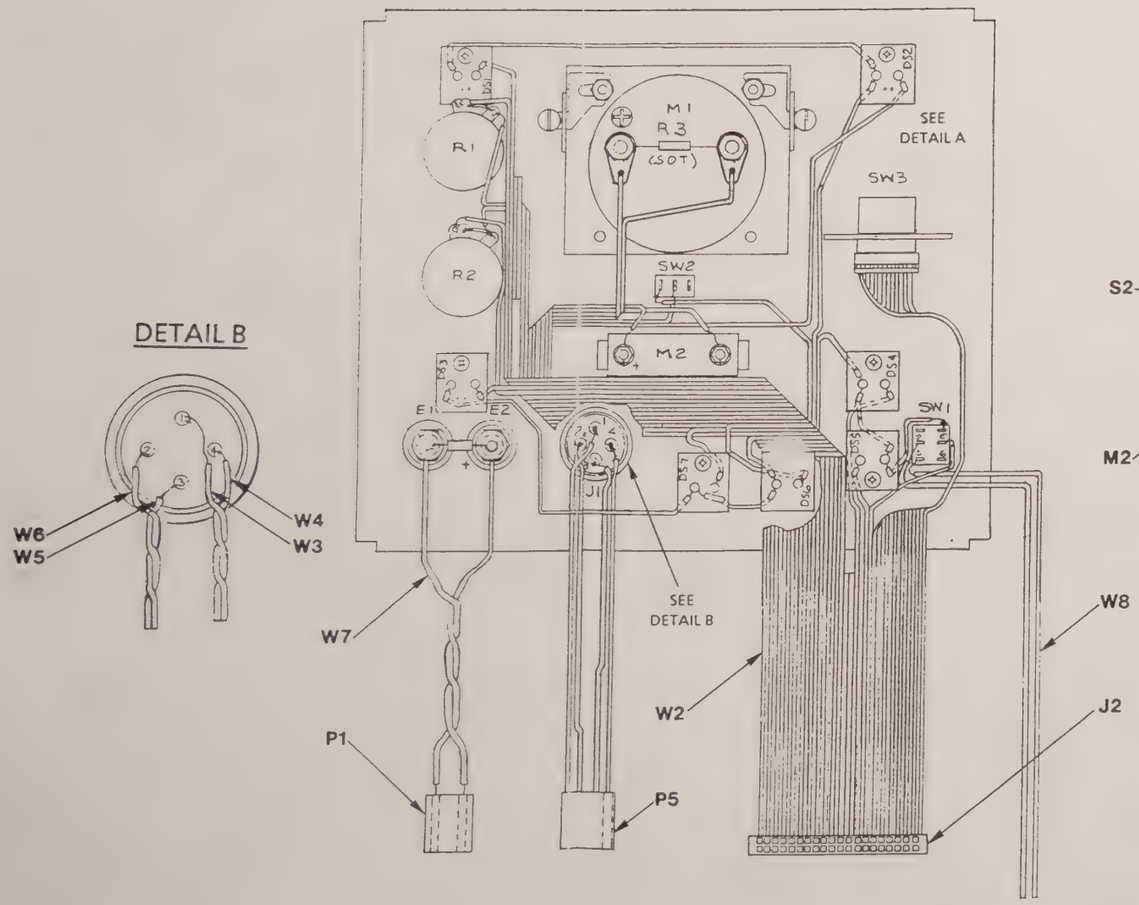


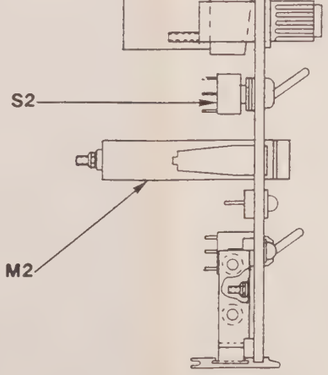
Figure 7-15
+30 V Power Supply Assy., A7
Component Location
138-419, Rev. B

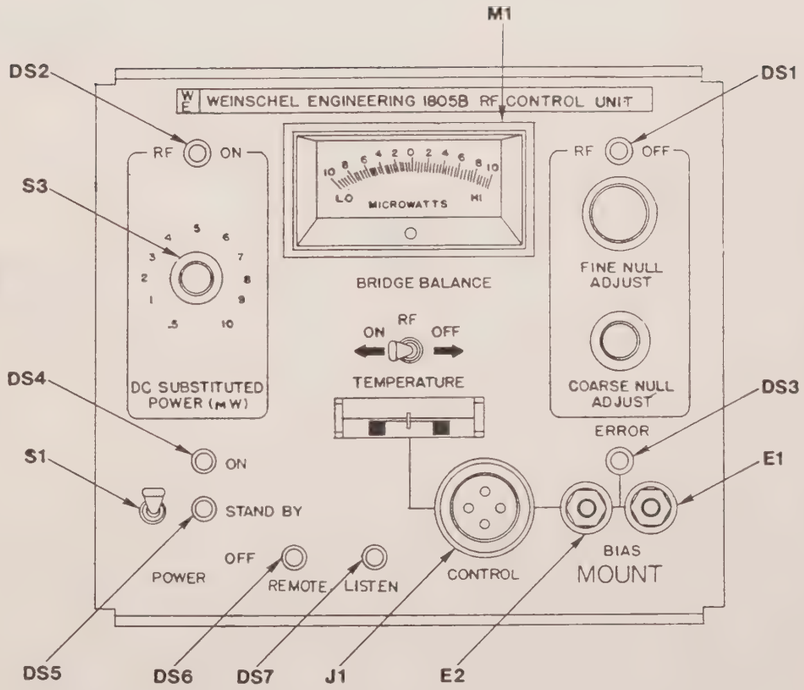


DETAIL A



DETAIL B





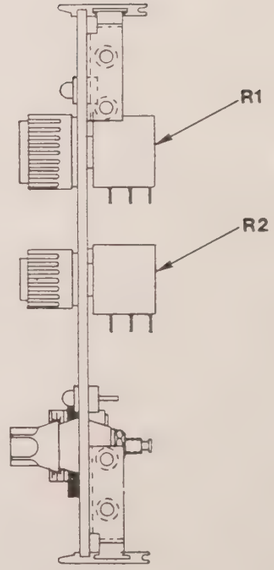
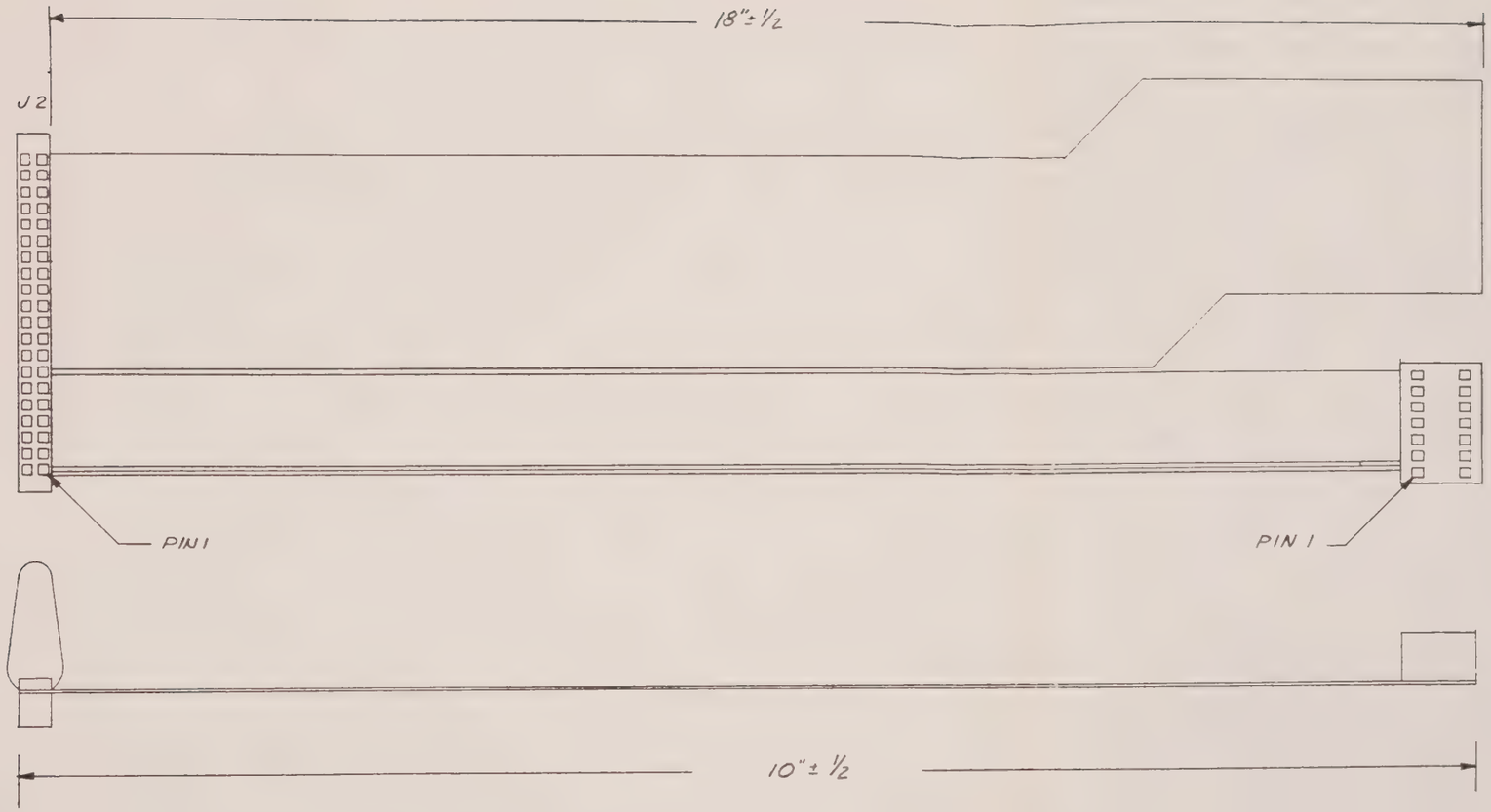
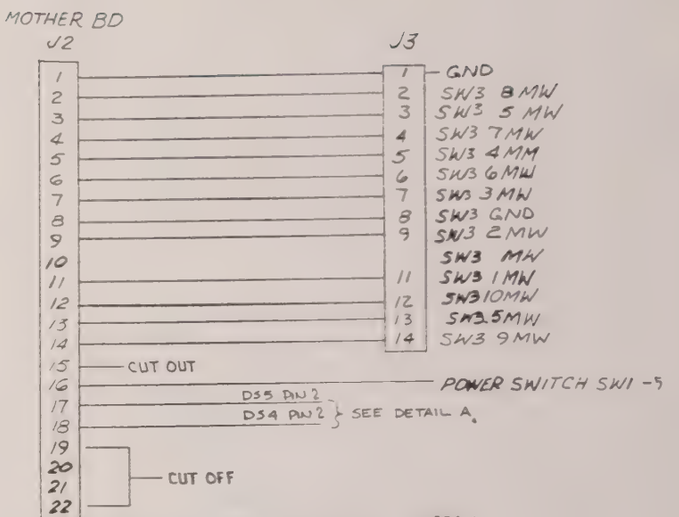
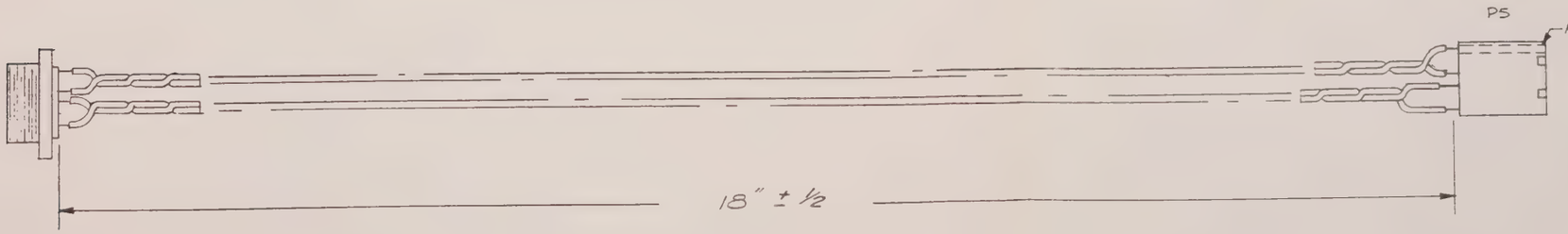
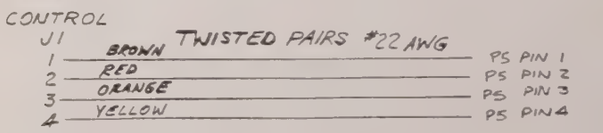


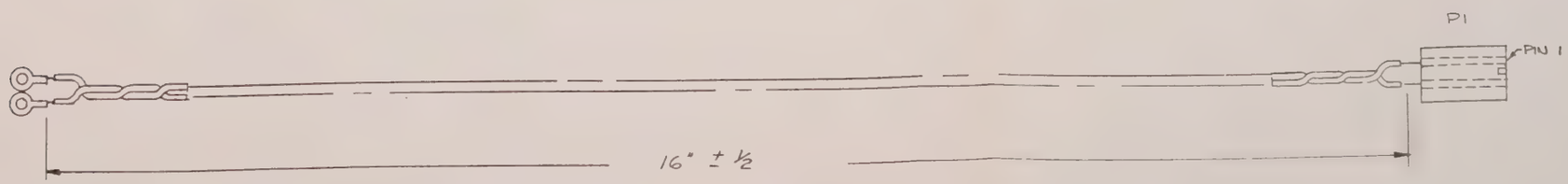
Figure 7-16
Front Panel Assy., A8
138-394-1, Rev. H
Sheet 1 of 2

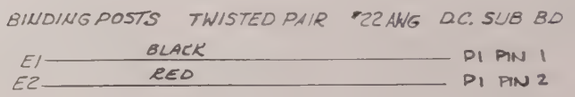












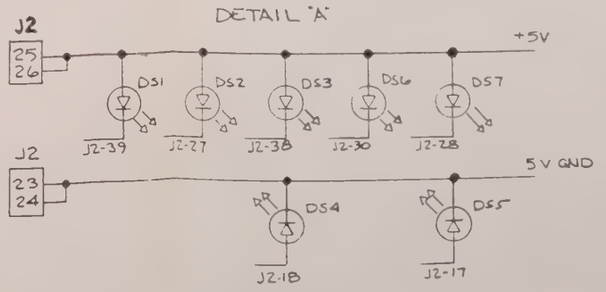
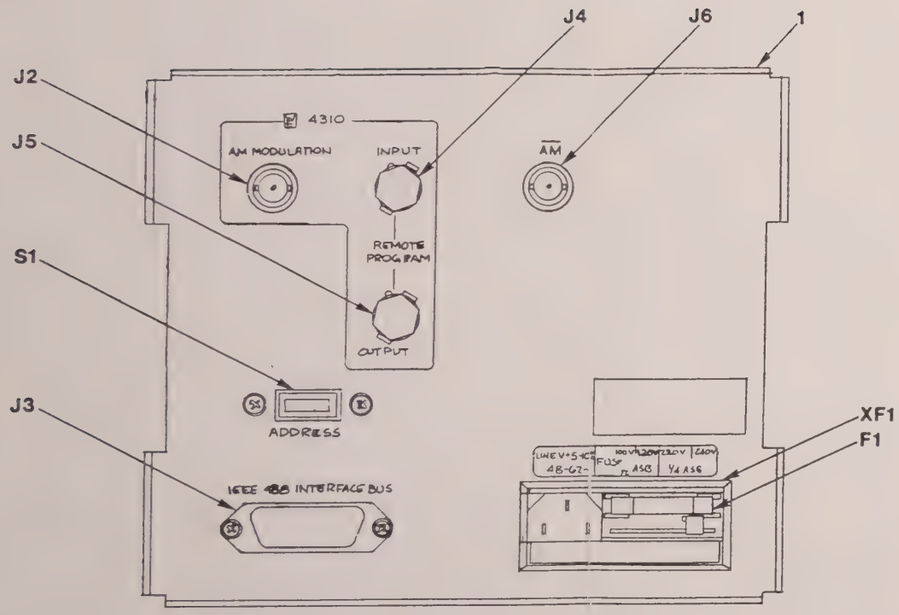
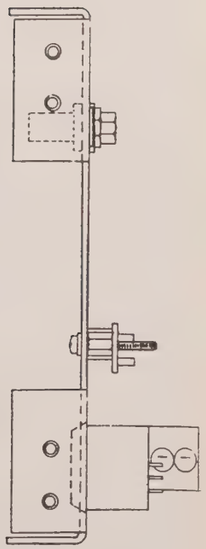
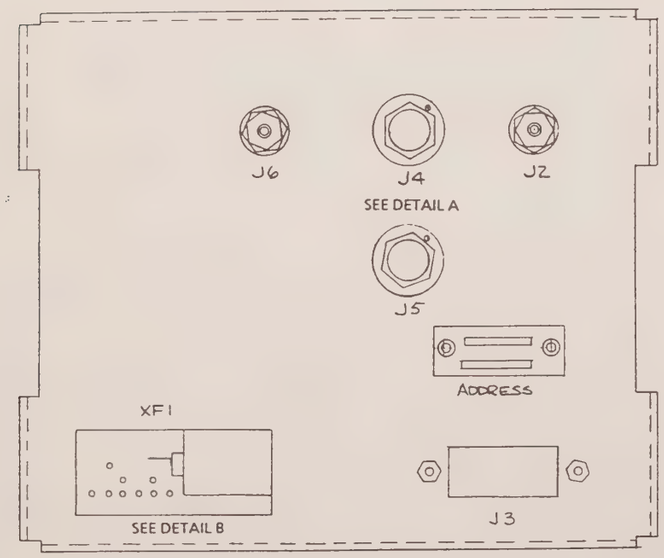
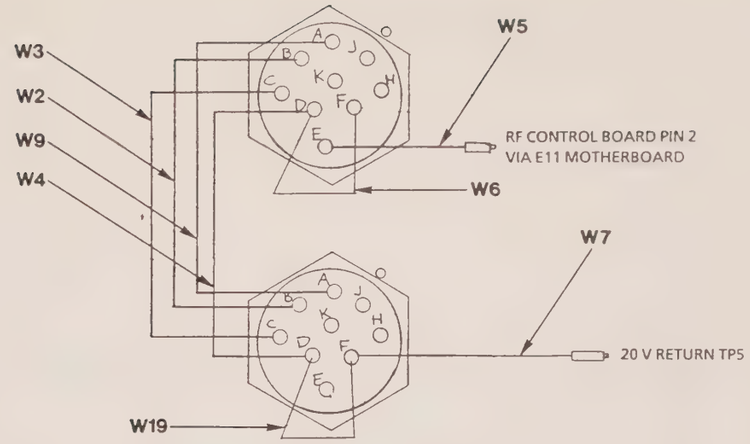


Figure 7-16
Front Panel Assy., A8
138-394-1, Rev. H
Sheet 2 of 2

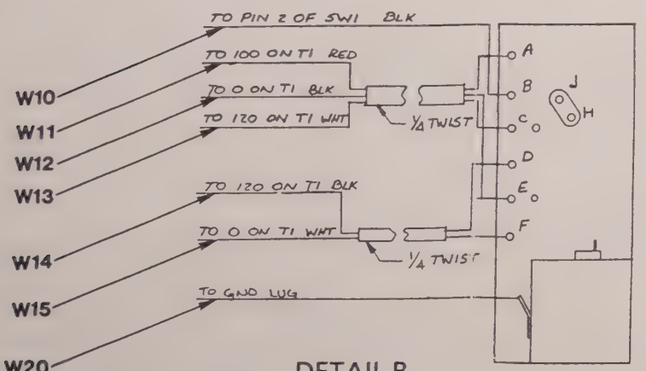








DETAIL A



DETAIL B

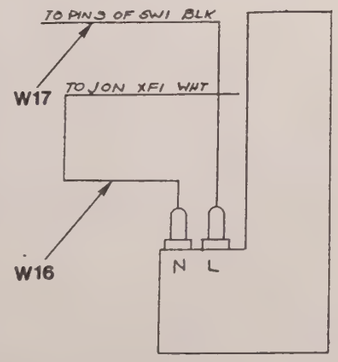


Figure 7-17
Rear Panel Assy., A9
Component Location
138-467-1, Rev. F

APPENDIX A
CARE AND HANDLING OF MICROWAVE COAXIAL CABLE ASSEMBLIES

A-1. CARE AND HANDLING OF ASSEMBLIES

To ensure accurate measurements and optimal performance of Weinschel Engineering products, the microwave coaxial cable assemblies used in system and test setups must be properly used and maintained. Proper connections, routine inspection of all cables, and cleaning of the connectors are extremely important procedures which can prolong the longevity and accuracy of equipment.

A-2. CABLE INSPECTION

Routinely check external cables for signs of cracked insulation, dents, twists, flattening, signs of jacket abrasion, or other signs of abuse. Wrinkles in the jacket indicate that the minimum bend radius has been exceeded. Most often, this occurs near the marker tubes and connectors.

Also inspect the connector interfaces for the following:

- Bent pins (male)
- Bent or missing tines (female)
- Worn or chipped plating
- Damaged or displaced dielectric inserts
- Thread damage
- Folded or mushroomed outer interface rims
- Mushroomed pin shoulders (male) or tine ends (female)
- Score lines on pins and outer interface rims visible to the unaided eye
- Recessed or protruding pins

It is advisable to clean the connectors prior to inspection to make subtle damage more apparent. If any of the above is noted, replace the assembly before its further use results in equipment damage. Also inspect the mating connectors for similar damage.

Table A-1 provides both Weinschel Engineering specifications and MIL-C-39012C data for the pin height of the various types of connectors. Pin height is defined as the vectorial distance along a horizontal axis of the pin shoulder from the electrical/mechanical reference plane.

Table A-1. Pin Height Specifications

CONNECTOR TYPE	W/E SPECIFICATION [1]			MIL-C-39012C
	MALE	FEMALE	SEXLESS	
7 mm	N/A	N/A	0.000 + .000 − .002[2]	See Figure A-1
N type	0.208 min	0.207 max	N/A	See Figure A-2
SMA	0.000 + .000 − .010	0.000 + .000 − .030	N/A	See Figure A-3
WPM	0.000 + .000 − .010	0.000 + .000 − .010	N/A	See Figure A-3
WPM-3	0.000 + .000 − .005	0.000 + .000 − .005	N/A	See Figure A-3
WPM-4	0.000 + .000 − .005	0.000 + .000 − .005	N/A	See Figure A-3
BNC	+ .210 - + .230	+ .186 - + .206	N/A	See Figure A-4
TNC	+ .210 - + .230	+ .186 - + .206	N/A	See Figure A-5

1 In all cases WE mates with MIL-C-39012C non-destructively.

2 Complies with IEEE Standard 287

Inspect the connector interface for signs of debris. Debris may be in the form of:

- Plating chips or other metal particles
- Dust or dirt
- Oily films
- Other miscellaneous foreign particles

If signs of debris are present, clean the connector interface as directed in Paragraph A-6.

A-3. MAKING INITIAL CONNECTIONS

Exercise caution when mating cables. Poor connections lead to poor system performance. They can also damage not only the cable assembly, but more significantly, front or rear panel connectors on the equipment itself which may be more difficult to repair.

ALIGNING CONNECTORS

Align the center lines of two connectors before actual mating. Male retaining nuts contain a small amount of necessary play which may make it possible to mate the threads without the pins being properly aligned. Pin misalignment can damage pins and dielectric inserts.

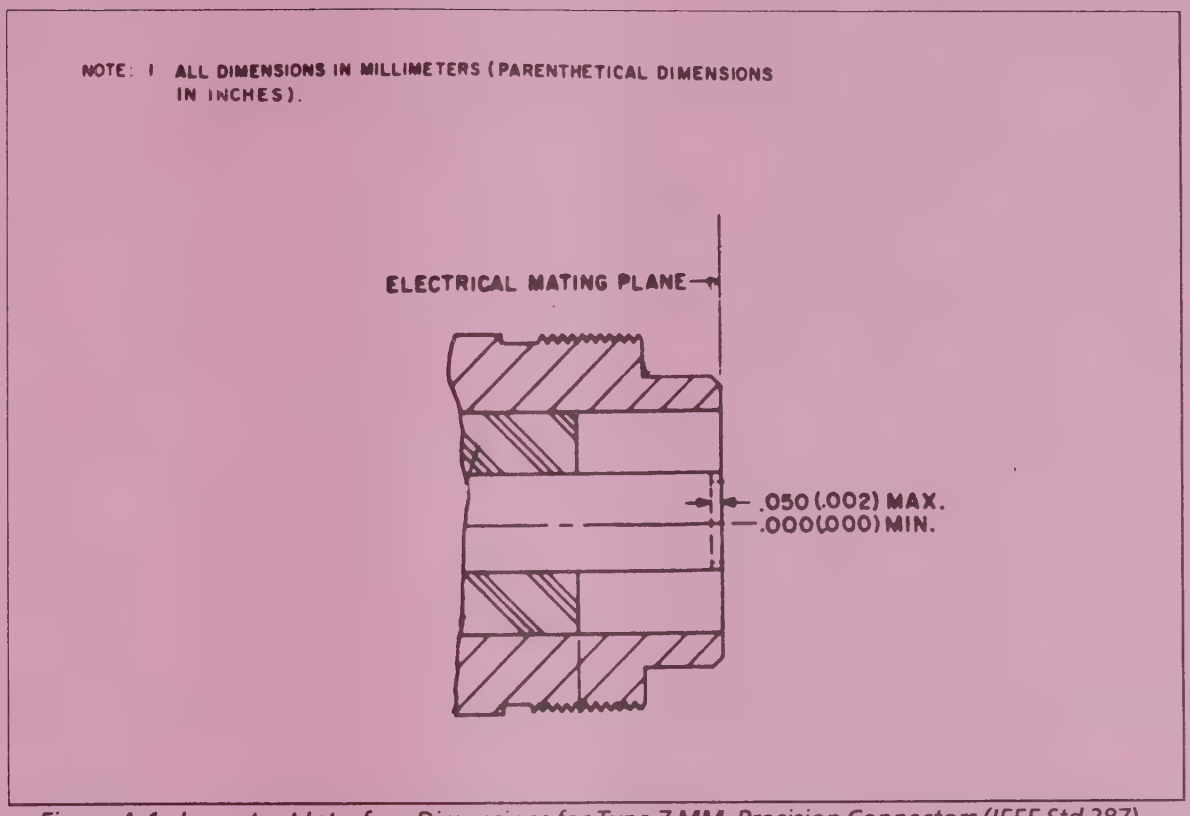

NOTE: 1 ALL DIMENSIONS IN MILLIMETERS (PARENTHETICAL DIMENSIONS IN INCHES).
ELECTRICAL MATING PLANE
.050 (.002) MAX.
.000 (.000) MIN.

Figure A-1. Important Interface Dimensions for Type 7 MM, Precision Connectors (IEEE Std 287)

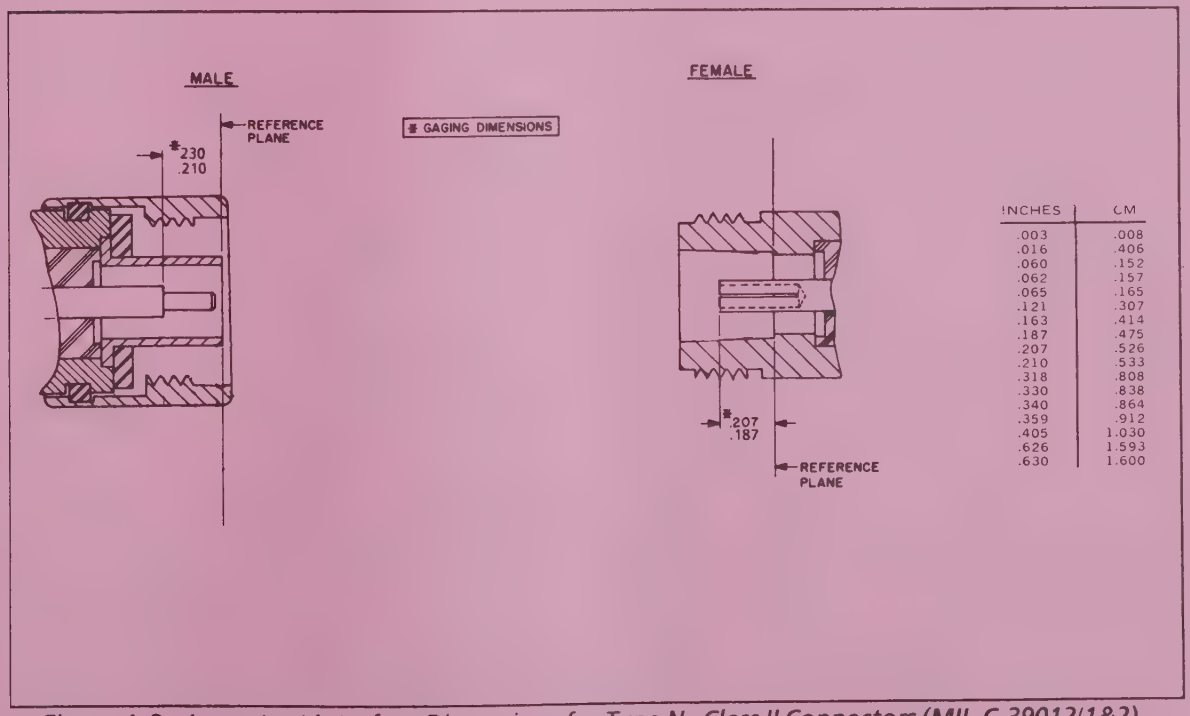


Figure A-2. Important Interface Dimensions for Type N, Class II Connectors (MIL-C-39012/1&2)

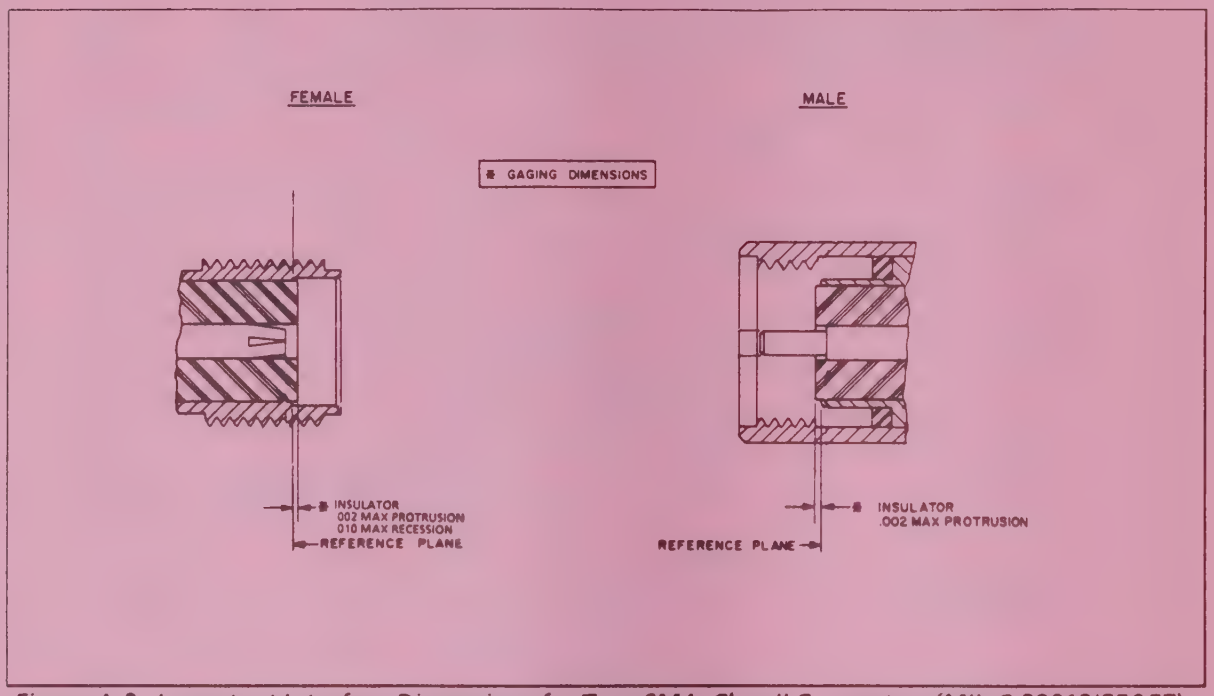


Figure A-3. Important Interface Dimensions for Type SMA, Class II Connectors (MIL-C-39012/55&57)

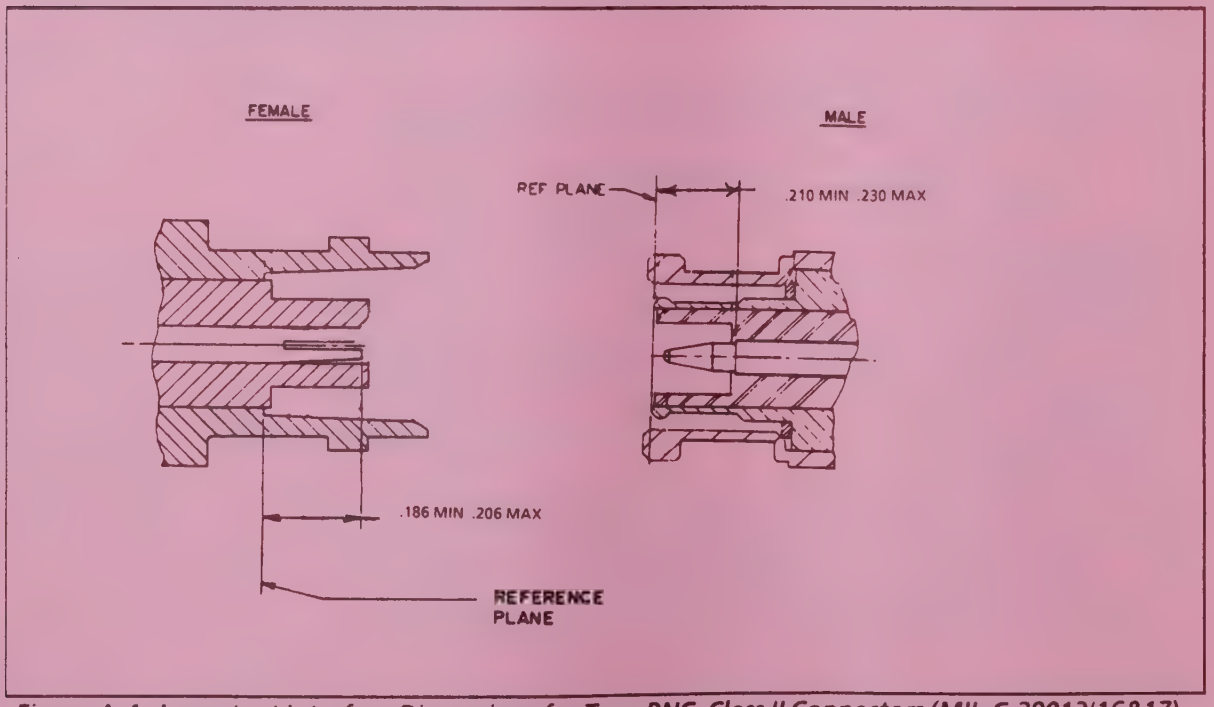


Figure A-4. Important Interface Dimensions for Type BNC, Class II Connectors (MIL-C-39012/16&17)

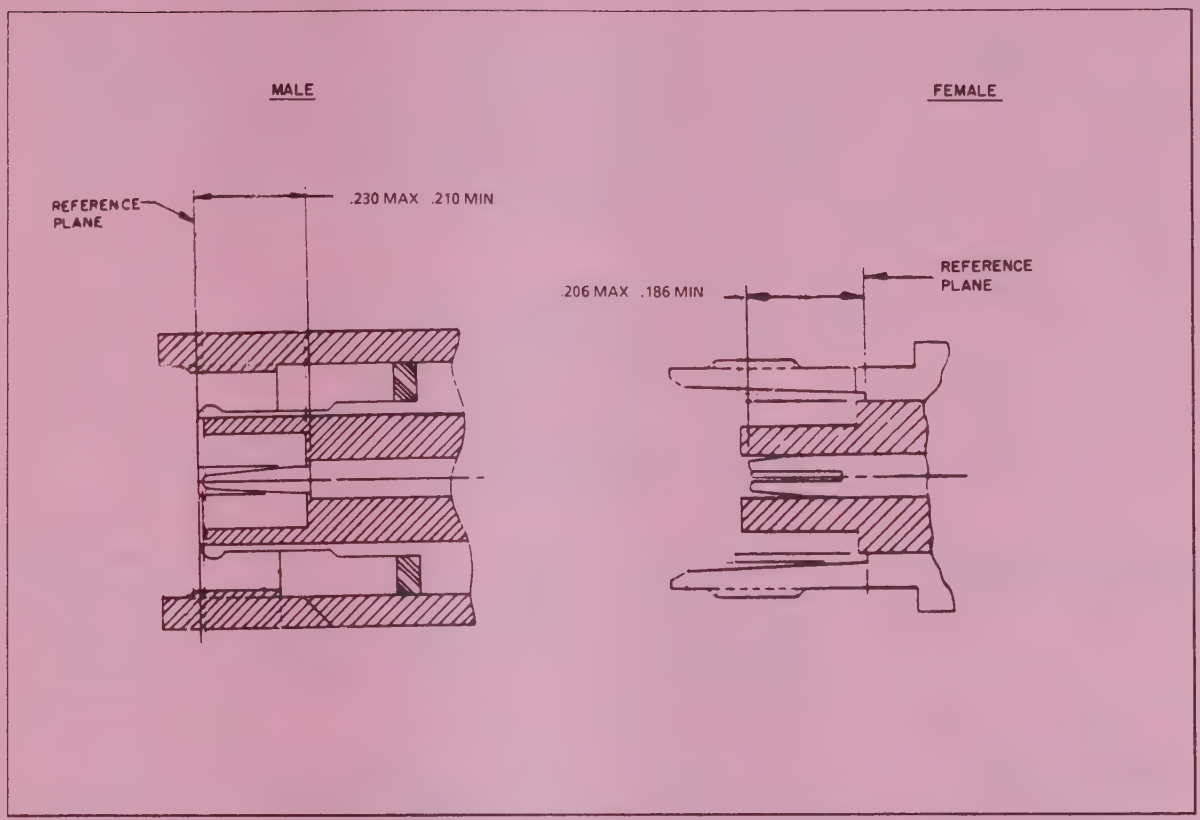


Figure A-5. Important Interface Dimensions for Type TNC, Class II Connectors (MIL-C-39012/26&27)

MATING CONNECTORS

Gently mate the connectors by hand, taking care not to force the coupling nut at the slightest resistance. It is often possible to *feel* whether or not the pins are mated. If the coupling nut is difficult to turn, either the pins are not mated, the coupling nut is cross-threaded, or one of the connectors has been damaged by excess torque.

Never hold a male connector coupling nut stationary while screwing a female connector into it. This rotation can erode the plating and damage both the outer interface rim as well as the pin. If the pins become locked, serious damage can result to both the equipment and the cable assembly.

A-4. ENSURING PROPER CONNECTOR TORQUE

OVERTORQUING

Once connectors have been properly mated, apply only the proper amount of torque. Overtorquing damages both connectors involved. Also, a connector which has been damaged by overtorquing, in turn, damages every connector to which it is subsequently mated. It usually leads to poor system performance as well. Overtorque can cause:

- Bent pins
- Recessed or protruding pins
- Recessed or protruding dielectrics
- Chipped plating
- Damaged coupling threads
- Coupling nut retaining ring damage
- Mushroomed outer interface shells
- Mushroomed pin shoulders

HEX-NUT TYPES

To mate a connector of the hex-nut type, always use a torque wrench set to the correct torque value. Tighten the connector slowly until the wrench *snaps*. Tightening too quickly can cause the wrench to exceed its set limit. Do not snap the wrench more than once as this also causes overtorque.

KNURLED NUTS

Tighten connectors with knurled nuts by hand. If this does not provide sufficient tightness use a hex-nut connector and torque wrench instead. *Never use pliers to tighten a connector.* Table A-2 recommends torque specifications for the various types of connectors.

Table A-2. Connector Torque Recommendations

CONNECTOR TYPE	RECOMMENDED TORQUE
7 mm connector with hex nut	14.0 in./lbs. ± 1 in./lbs.
Type N connector with hex nut	14.0 in./lbs. ± 1 in./lbs.
SMA connector	7.5 in./lbs. ± .5 in./lbs.
WPM	7.5 in./lbs. ± .5 in./lbs.
WPM-3	7.5 in./lbs. ± .5 in./lbs.
WPM-4	7.5 in./lbs. ± .5 in./lbs.
Type N connector (knurled)	hand-tight
TNC connector (knurled)	hand-tight
BNC	hand-tight

A-5. PROPER CABLE HANDLING

Never exceed the minimum bend radius specified for a cable. Guard against tight bends at the end of connector strain relief tubing, or at the ends of marker tubing where they may be less noticeable. Although cable bend may seem slight, the actual radius of the bend at the point of angular departure may be far smaller than the acceptable radius.

Never pinch, crush or drop objects on cable assemblies. Also, do not drag a cable over sharp edges as this will pinch it and cause it to exceed the minimum bend radius.

Never use a cable assembly to pull a piece of equipment. Cables and connectors are not designed to support or move equipment.

SECURING CABLES

Use toothed, rubber-lined "P-clamps" to hold cables in place. If it is necessary to use tie-wraps, use the widest possible wrap and the lowest setting on the gun to ensure the minimum pressure on the cable.

STORING CABLES

When storing cables, minimize cable "set" by coiling them in large diameters (1 or 2 feet). Unroll the cable properly when it is ready to be used; do not pull the loops out hastily. Similarly, re-roll them when storing them away again.

A-6. CLEANING CONNECTOR INTERFACES

Use the following guidelines in cleaning connector interfaces:

A. Do not use chlorinated solvents including common tap water. These solvents are extremely penetrating and sometimes ruin otherwise good devices and assemblies.

B. Moisten a cotton swab with isopropyl alcohol. Roll the swab on a paper towel to remove excess.

C. Use the moistened cotton swab to wipe away debris. Do not try to dissolve the debris by overwetting the swab.

D. Repeat the cleaning process using additional swabs as necessary. If metallic particles are embedded in the dielectric, use an eyeglass and a sharp pick in an attempt to dislodge them. Swab again.

E. When satisfied that the interfaces are clean, blow them dry with dry compressed air, or preferably dry nitrogen (pressurized spray cans work well). Do not use breath.

F. Clean the mating connectors. These may be the source of the debris.

Model 1805B (IM-200) Revision Record

REVISION	DATE	DESCRIPTION	APPLICABLE SERIAL NUMBERS
A	12/87	Initial Issue	All Units
B	4/88	Errata in Table 6-6	All Units
C	7/89	Company Name Change	All New Units

K&M Company
TORRANCE,CA 90503

VB11-10

MP MASTER
MA35049